ONLINE SCIENTIFIC ANALYSIS TOOLS FOR ASTRONOMY: THE SSDC WEB SERVICES

F. Lucarelli

ASI Space Science Data Center (SSDC)

INAF - Astr. Obs. of Rome

OUTLINE

- The MWL environment of the ASI-SSDC and the SSDC online services
- The Multi-Mission Interactive Archive (MMIA)
- The SSDC resident catalogues
- SSDC Use Cases
- (VO services)
- Summary and outlook

SSDC OVERVIEW

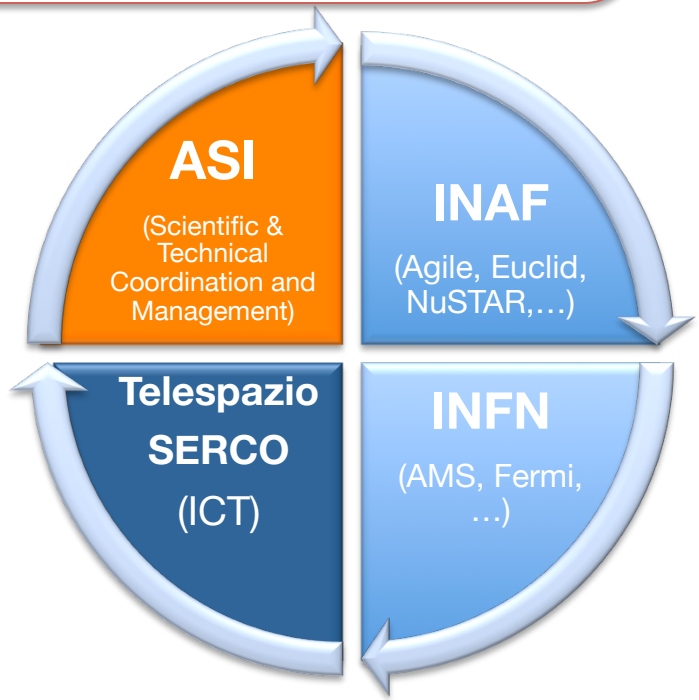
The Space Science Data Center is a Research Infrastructure of the Italian Space Agency

MAIN GOAL

acquire, manage, process and distribute data from (mainly) space based mission adopting the FAIR (Findable, Accessible, Interoperable, Reusable) principles.

- SSDC management and organization involves several Research Institutes:
  - **ASI** – Italian Space Agency
  - **INAF** – National Institute for Astrophysics
  - **INFN** – National Institute for Nuclear Physics

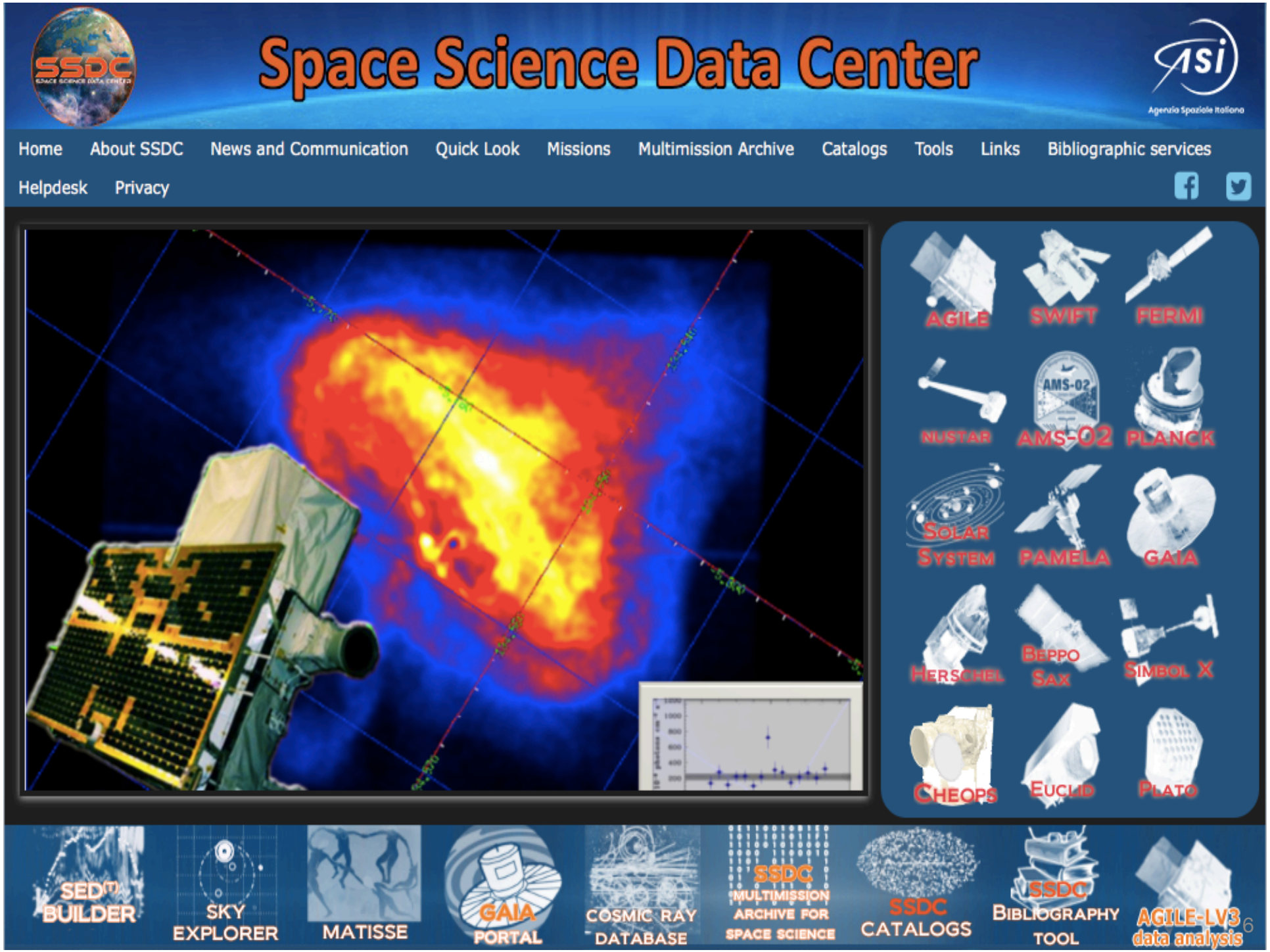
- Industries are involved for Information and Communication Technology supports.



THE ASI-SSDC MWL EXPERIENCE

- The ASI-SSDC (former ASDC):
  - wide experience as MWL data center, both for low-level data products (AGILE data center, Fermi-LAT/SWIFT/… data mirror center) and high-level data, data products and catalogs (GAIA, AGILE, FERMI-LAT, ...).
  - Data and data products integrated in a fully MWL environment (MMIA: Multi-Mission Interactive Archive).
  - Possibility to perform cross-catalog searches between resident and external catalogs.
  - Powerful tools to extract SED of sources and modelization.

THE SSDC WEB GATEWAY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AGILE-LV3 data analysis

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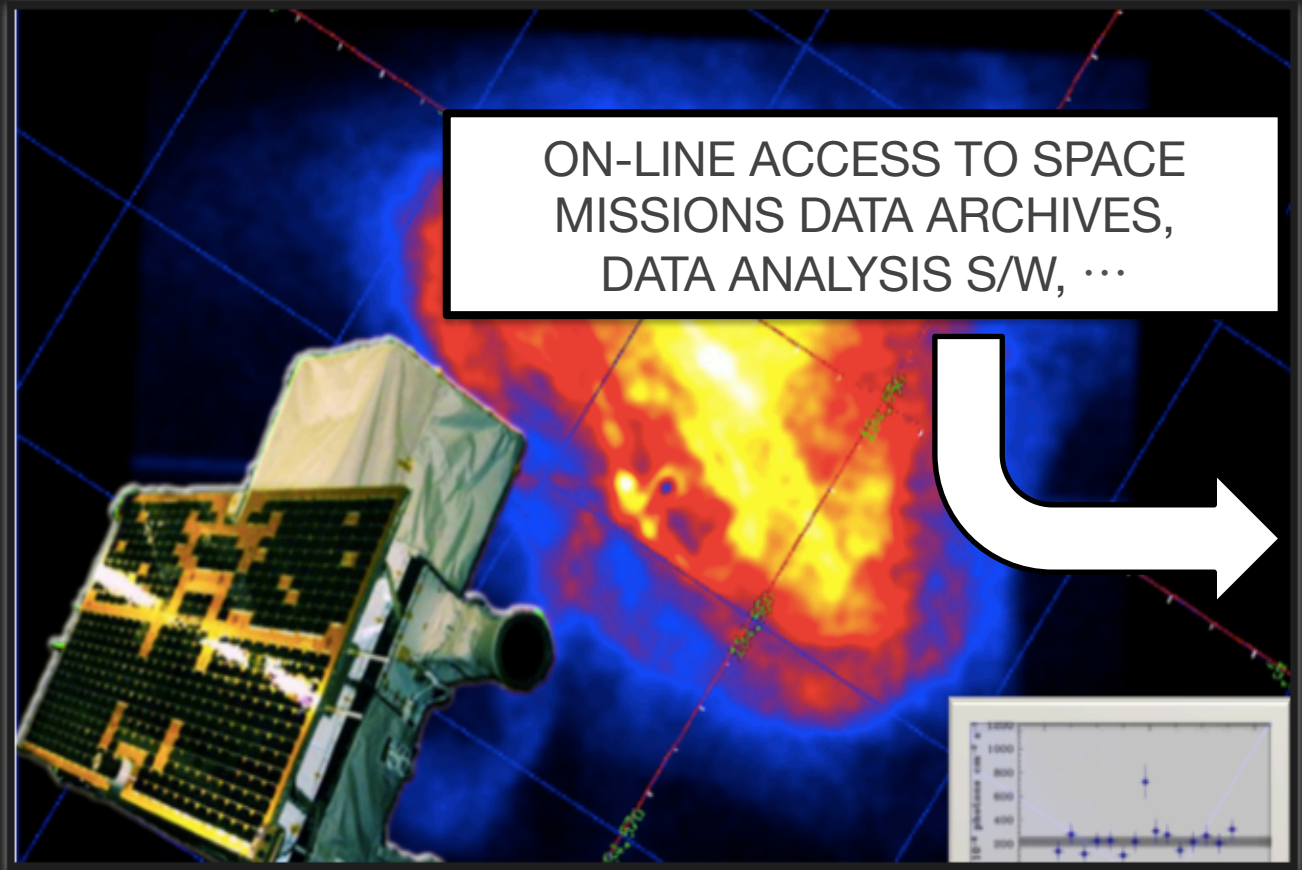
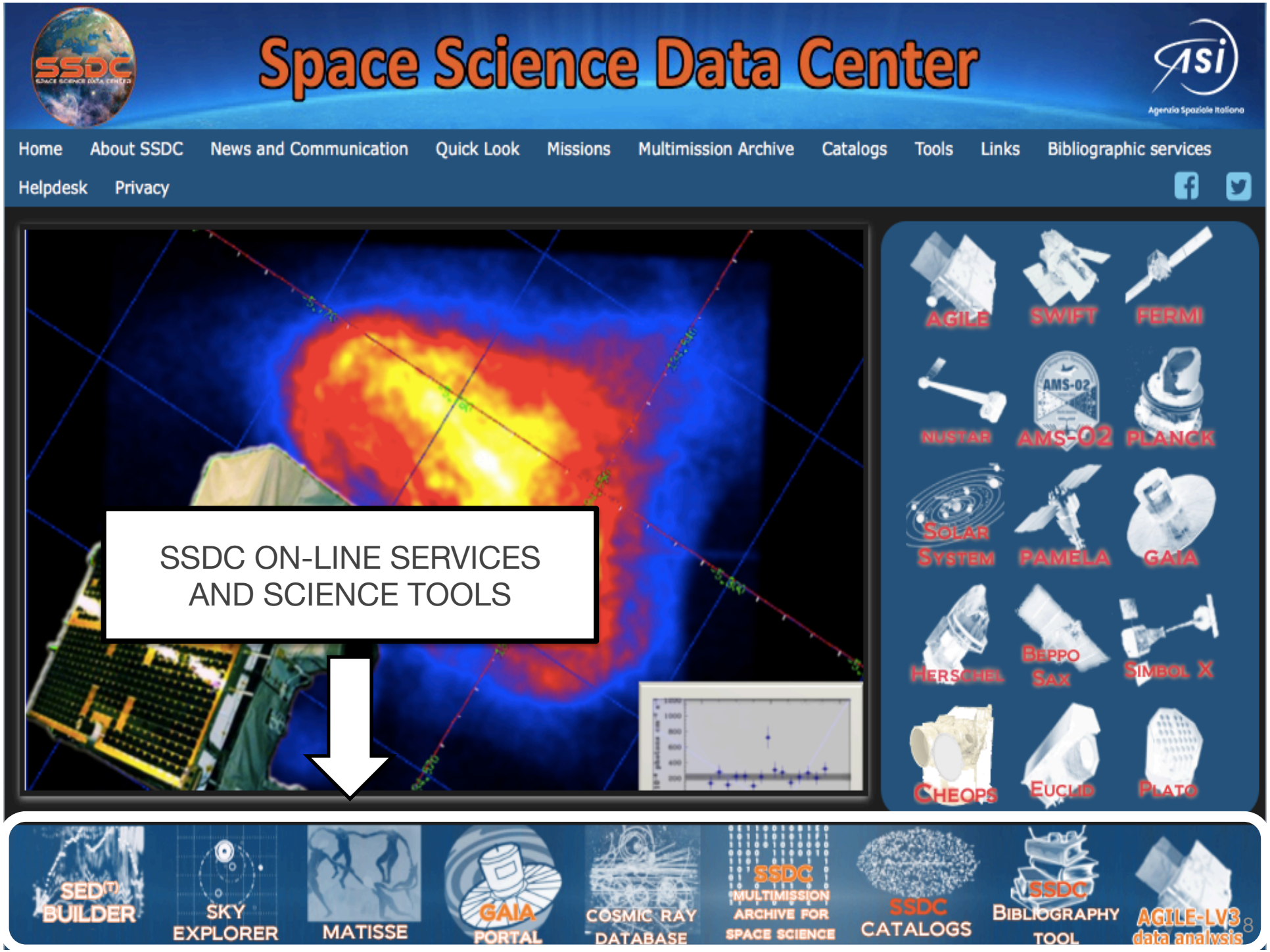


ON-LINE ACCESS TO SPACE MISSIONS DATA ARCHIVES, DATA ANALYSIS S/W, …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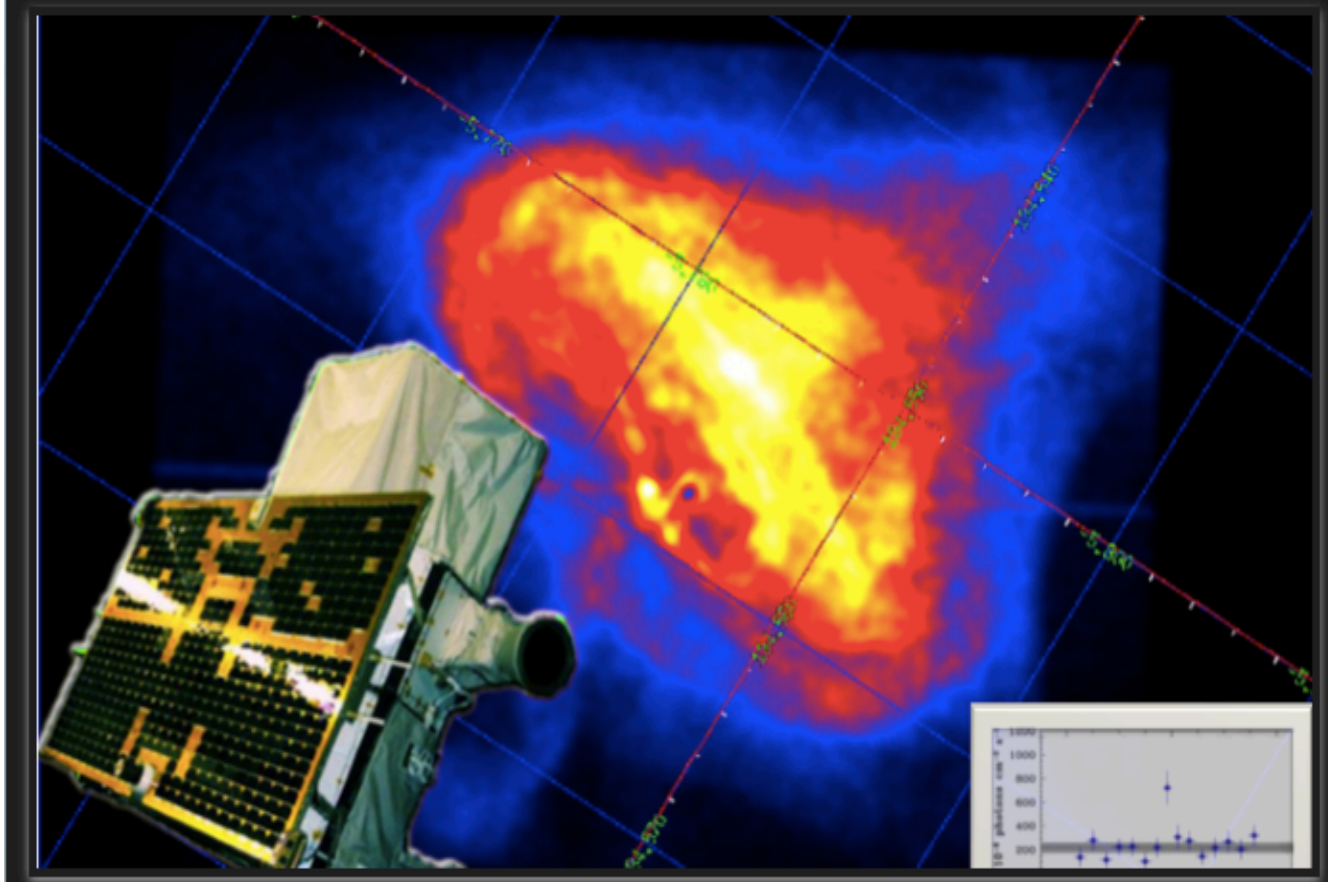


AGILE | SWIFT | FERMI

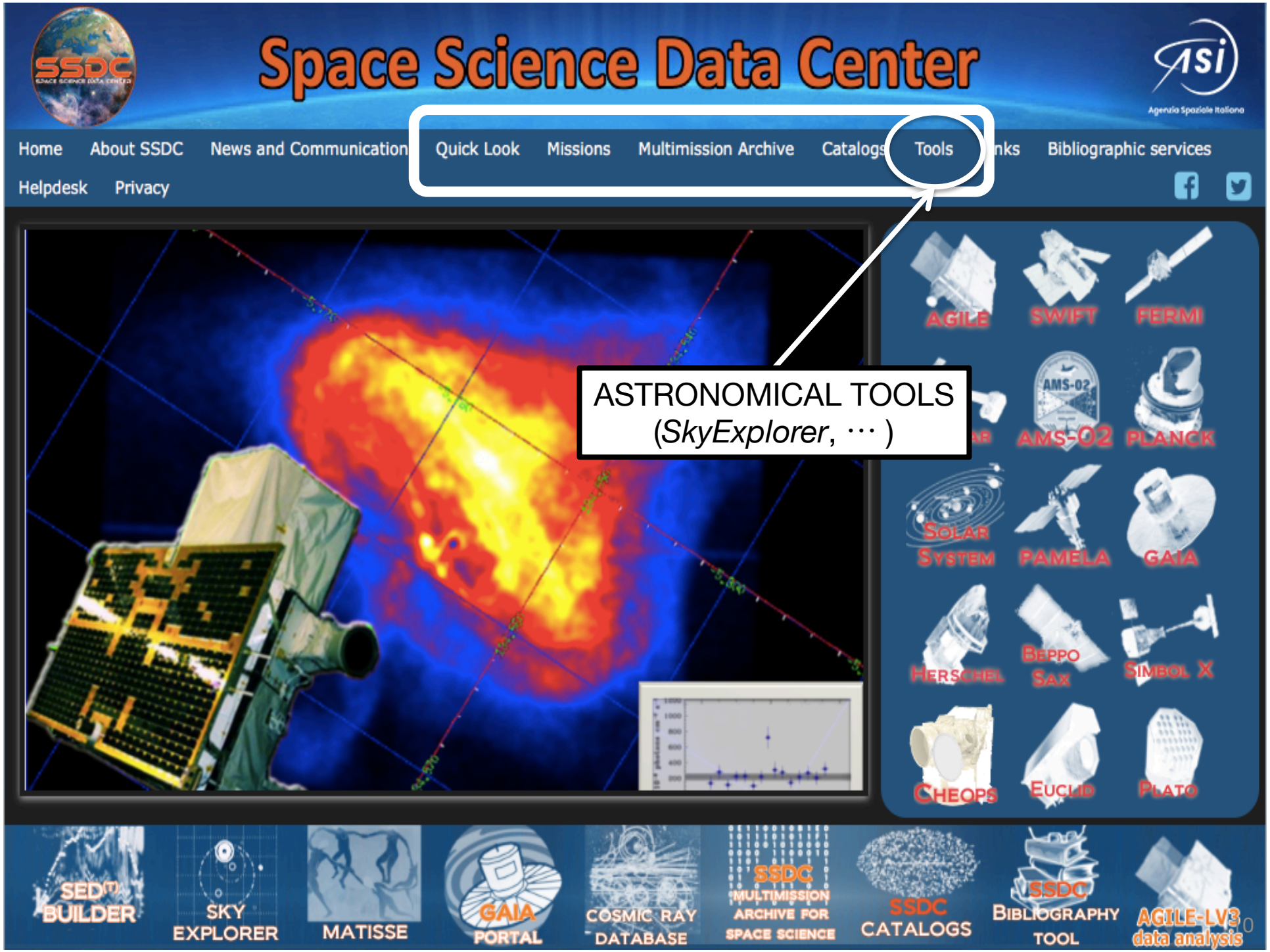
NUSTAR | AMS-02 | PLANCK

SOLAR SYSTEM | PAMELA | GAIA

HERSCHEL | BEPPO SAX | SIMBOL X

CHEOPS | EUCLID | PLATO

SED BUILDER | SKY EXPLORER | MATISSE | GAIA PORTAL | COSMIC RAY DATABASE | SSDC MULTIMISSION ARCHIVE FOR SPACE SCIENCE | SSDC CATALOGS | SSDC BIBLIOGRAPHY TOOL | AGILE-LV3 data analysis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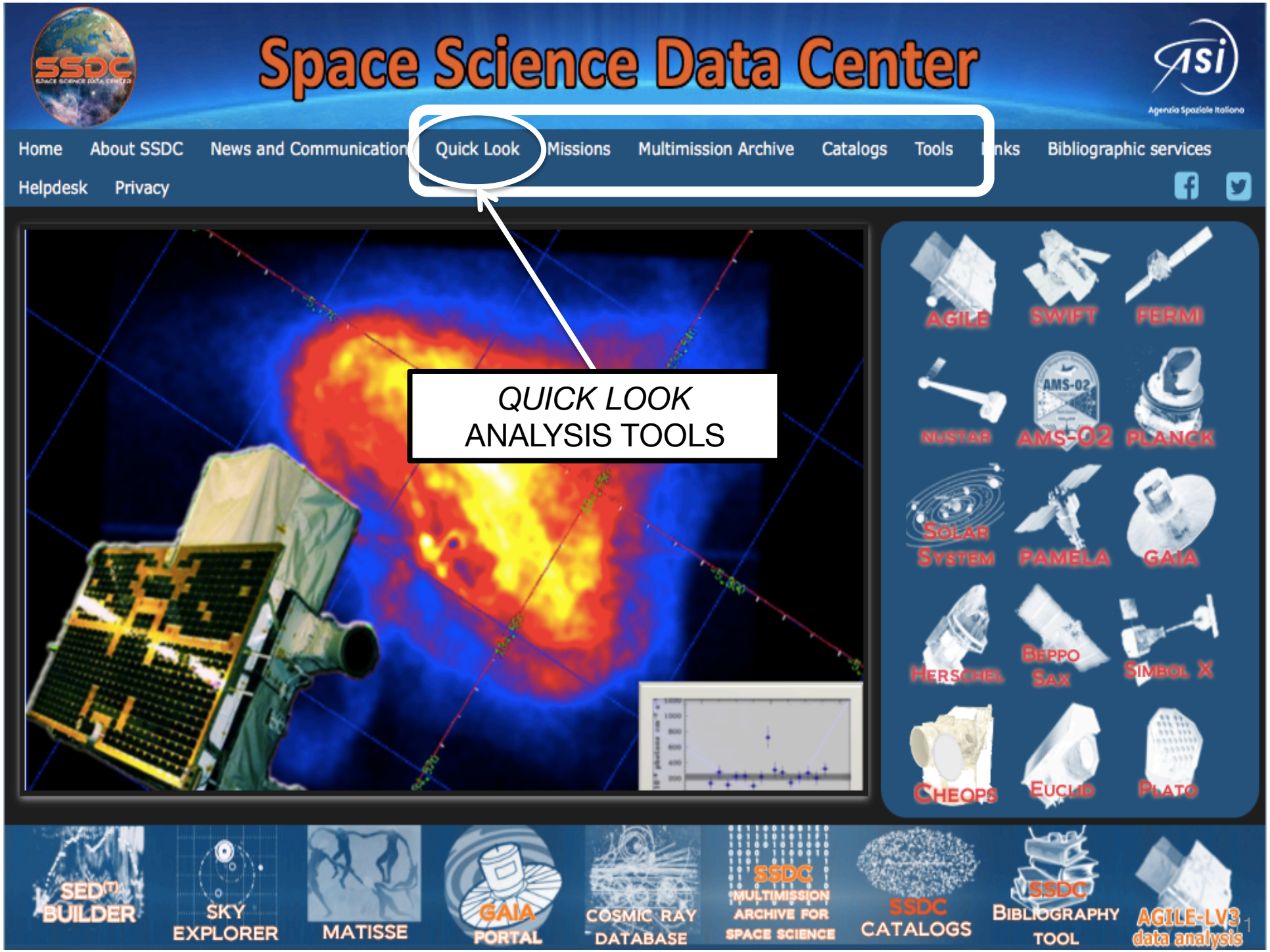
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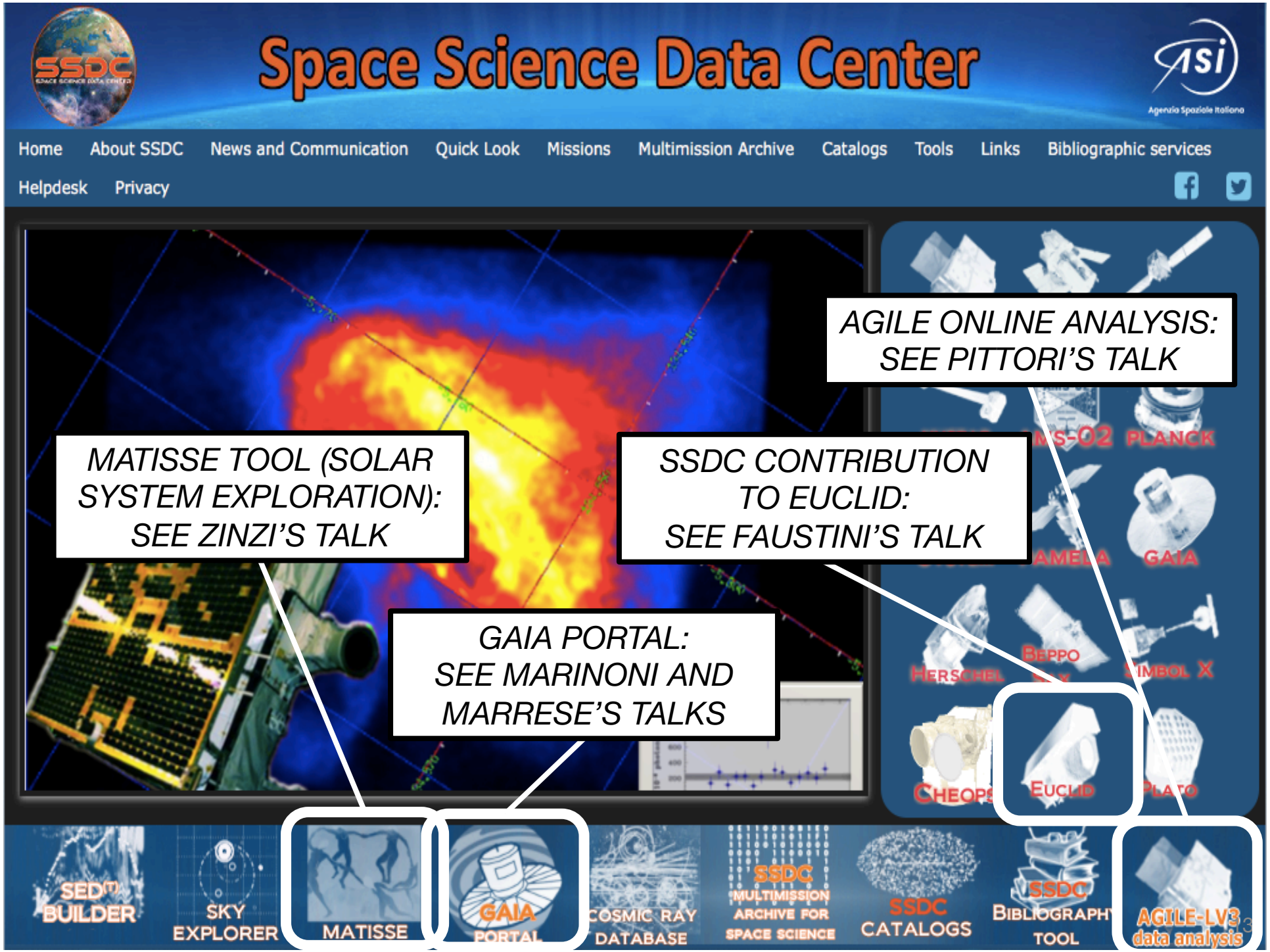
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AGILE ONLINE ANALYSIS: SEE PITTORI'S TALK
MATISSE TOOL (SOLAR SYSTEM EXPLORATION): SEE ZINZI'S TALK
SSDC CONTRIBUTION TO EUCLID: SEE FAUSTINI'S TALK
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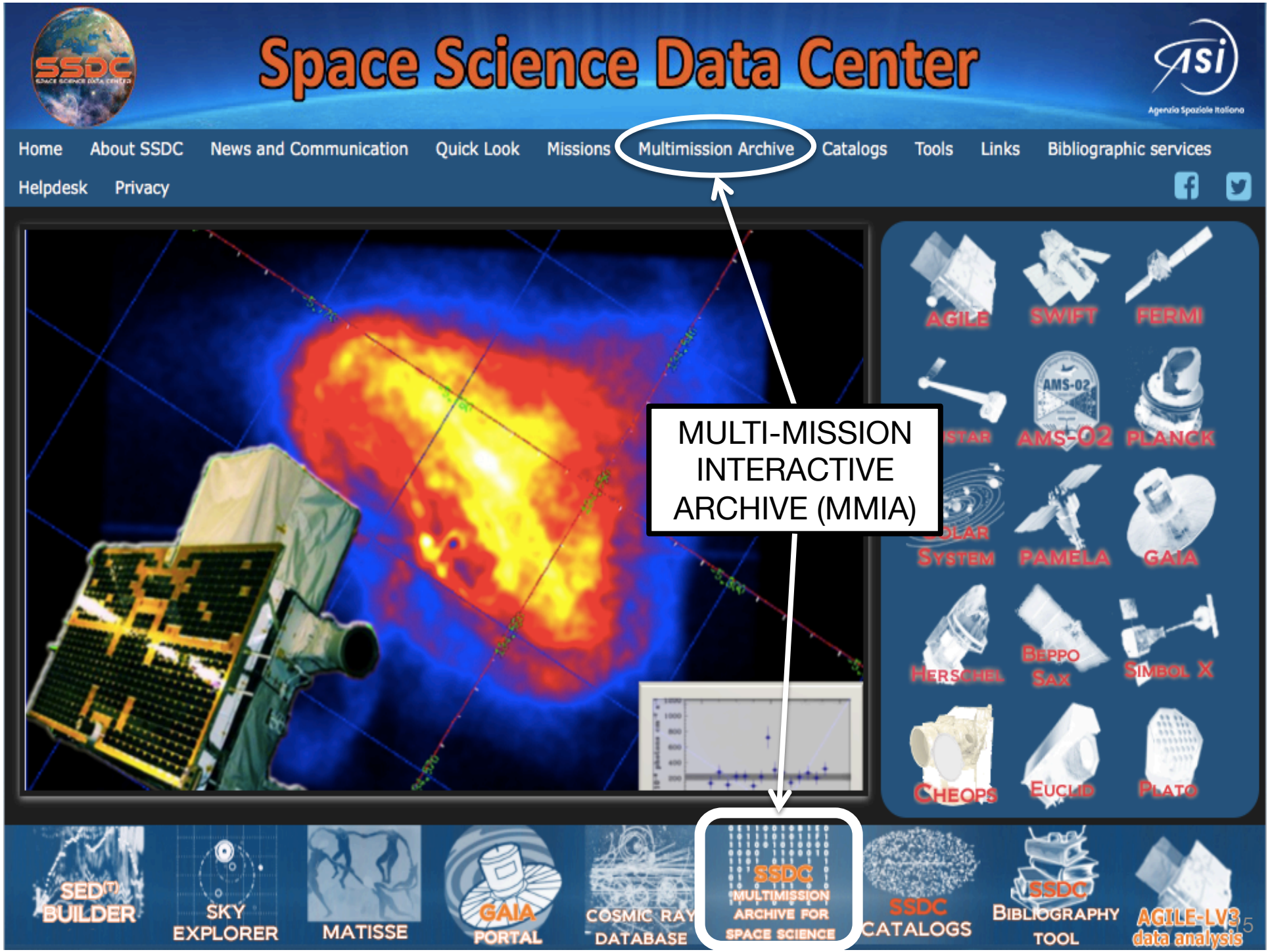
THE SSDC MULTI-MISSION INTERACTIVE ARCHIVE (MMIA)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Multi-Mission Interactive Archive for Space Science

Astrophysics/Cosmology

Astrophysics/Cosmology | Exploration of the Solar System | Particle Astrophysics Cosmic rays | Atmospheric Physics TGF

all missions ☑

Radio-Micro wave ☑
- ☑ Planck

IR-Optic-UV ☑
- ☑ Herschel
- ☑ Swift-UVOT

X ray ☑
- ☑ ASCA
- ☑ BeppoSAX
- ☑ Einstein
- ☑ Exosat
- ☑ NuSTAR
- ☑ ROSAT
- ☑ Swift-XRT

Gamma ray ☑
- ☑ Agile
- ☑ Agile-LV3
- ☑ Egret
- ☑ Fermi
- ☑ Swift-BAT

all missions ☐
- ☐ *Rosetta*
- ☐ *Dawn*
- ☐ *Chang'E 1*
- ☐ *Chang'E 2*
- ☐ *Messenger*

all missions ☐
- ☐ *AMS-01*
- ☐ *AMS-02*
- ☐ *BESS-Polar I*
- ☐ *BESS-Polar II*
- ☐ *CALET*
- ☐ *CREAM*
- ☐ *Fermi-LAT*
- ☐ *Pamela*
- ☐ *TS93*
- ☐ *Chang'E 1 (soon available)*
- ☐ *Chang'E 2 (soon available)*

all missions ☐
- ☐ *Agile*

Spectral band (Energy (keV) **):** from 1e -8 to 1e 9

[1.00e-8 keV -- 1.00e9 keV]

Sensitivity (mCrab): 1e 3

[1.00e+3 mCrab]

Temporal range (Year): from 1975 to 2019

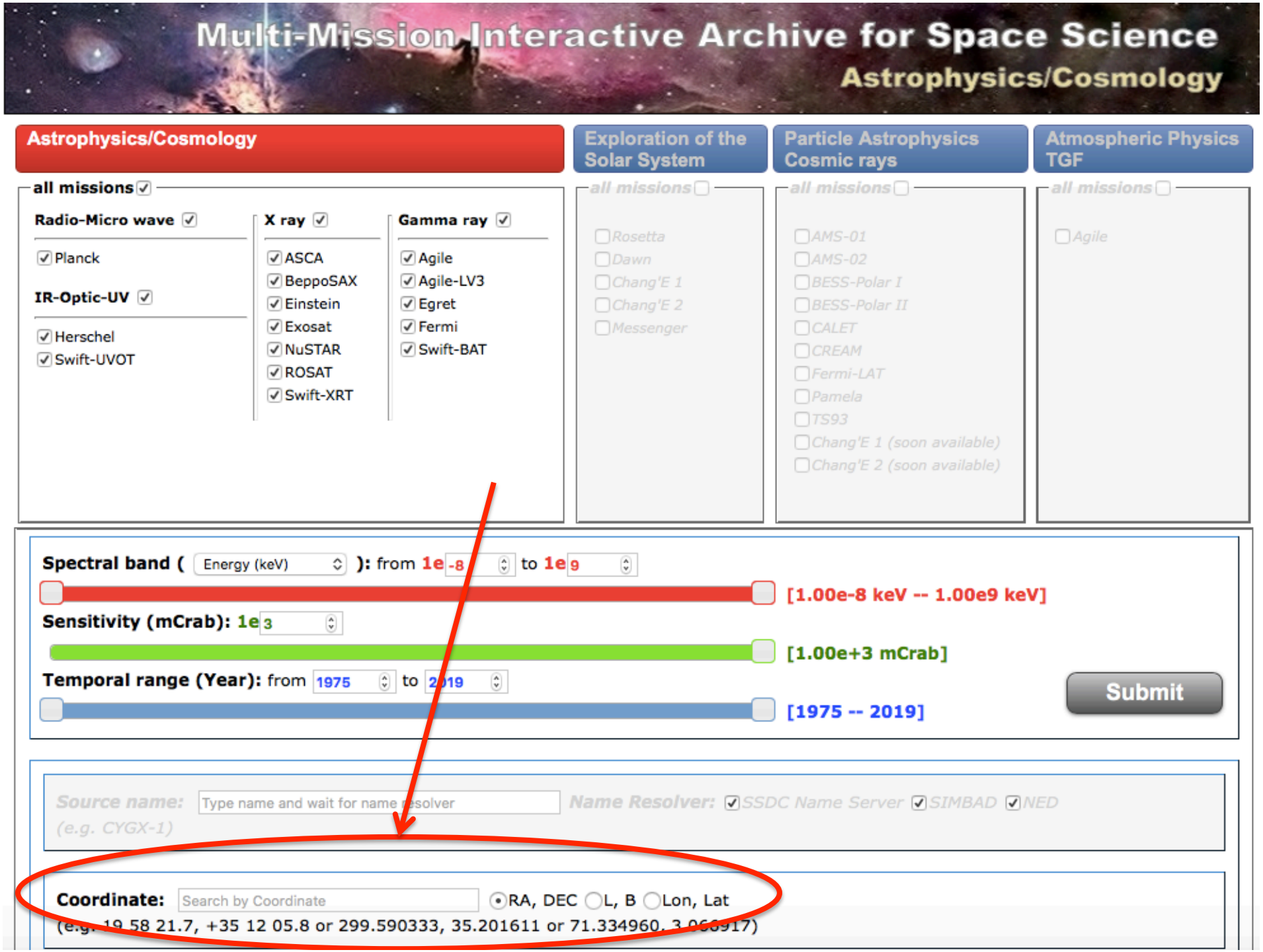
[1975 -- 2019]

Submit

Source name: Type name and wait for name resolver
(e.g. CYGX-1)

Name Resolver: ☑ SSDC Name Server ☑ SIMBAD ☑ NED

Coordinate: Search by Coordinate ◉ *RA, DEC* ○ *L, B* ○ *Lon, Lat*
(e.g. 19 58 21.7, +35 12 05.8 or 299.590333, 35.201611 or 71.334960, 3.066917)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Chang'E 1 (soon available)
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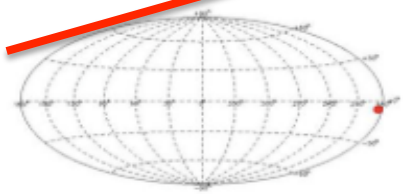
all missions
Agile
Spectral band (Energy (keV)): from 1e -8 to 1e 9
[1.00e-8 keV -- 1.00e9 keV]
Sensitivity (mCrab): 1e 3
[1.00e+3 mCrab]
Temporal range (Year): from 1975 to 2019
[1975 -- 2019]
Submit
Source name: Type name and wait for name resolver
(e.g. CYGX-1)
Name Resolver: SSDC Name Server SIMBAD NED
Coordinate: Search by Coordinate
RA, DEC L, B Lon, Lat
(e.g. 19 58 21.7, +35 12 05.8 or 299.590333, 35.201611 or 71.334960, 3.066917)

THE MULTI-MISSION INTERACTIVE ARCHIVE

Multi-Mission Interactive Archive

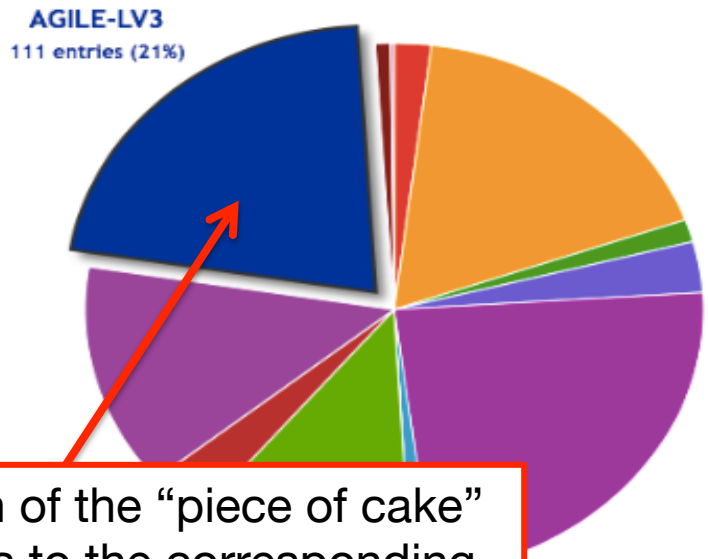
Query results for: **CRAB**
RA = **83.632977** (deg); DEC = **22.014434** (deg);
Source name resolved by **ASDC**

Summary of the observations on the Crab position considering all the data available @ SSDC



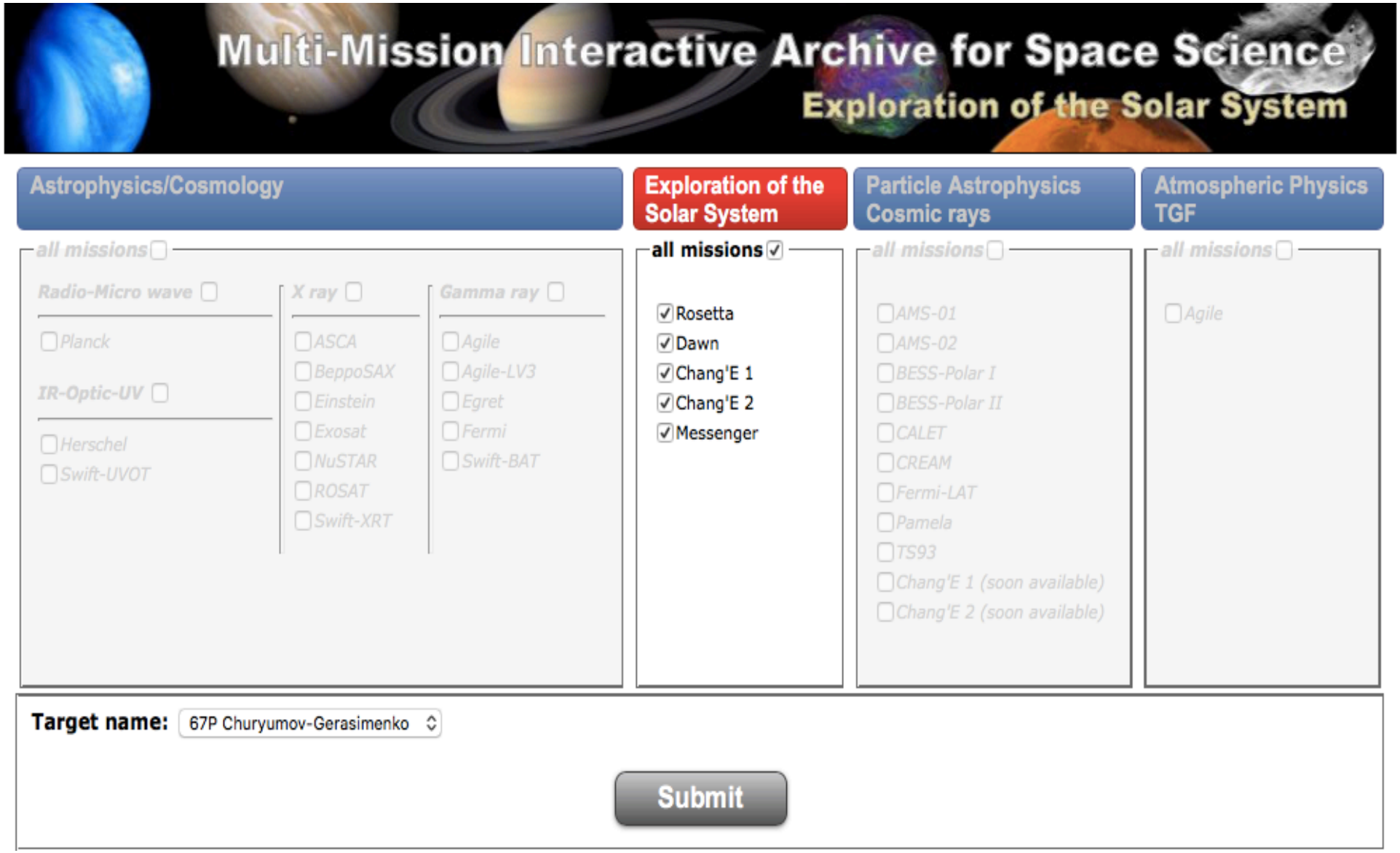
Source Names

PKS0531+219
in time range between 1900 and 2017
By name via NED
By coordinates via ADS



MISSION	ENTRIES
PLANCK	0
HERSCHEL	10
SWIFT	91
ASCA	7
BeppoSax NFI	16
BeppoSax WFC	124
EINSTEIN	6
EXOSAT	0
NUSTAR	61
ROSAT	16
AGILE	70
AGILE-LV3	111
EGRET	4
FERMI	1

Clicking on each of the “piece of cake” you have access to the corresponding data and interactive data analysis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Exploration of the Solar System
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Atmospheric Physics TGF
all missions
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Planck
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Herschel
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X ray
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BeppoSAX
Einstein
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Messenger
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BESS-Polar I
BESS-Polar II
CALET
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Pamela
TS93
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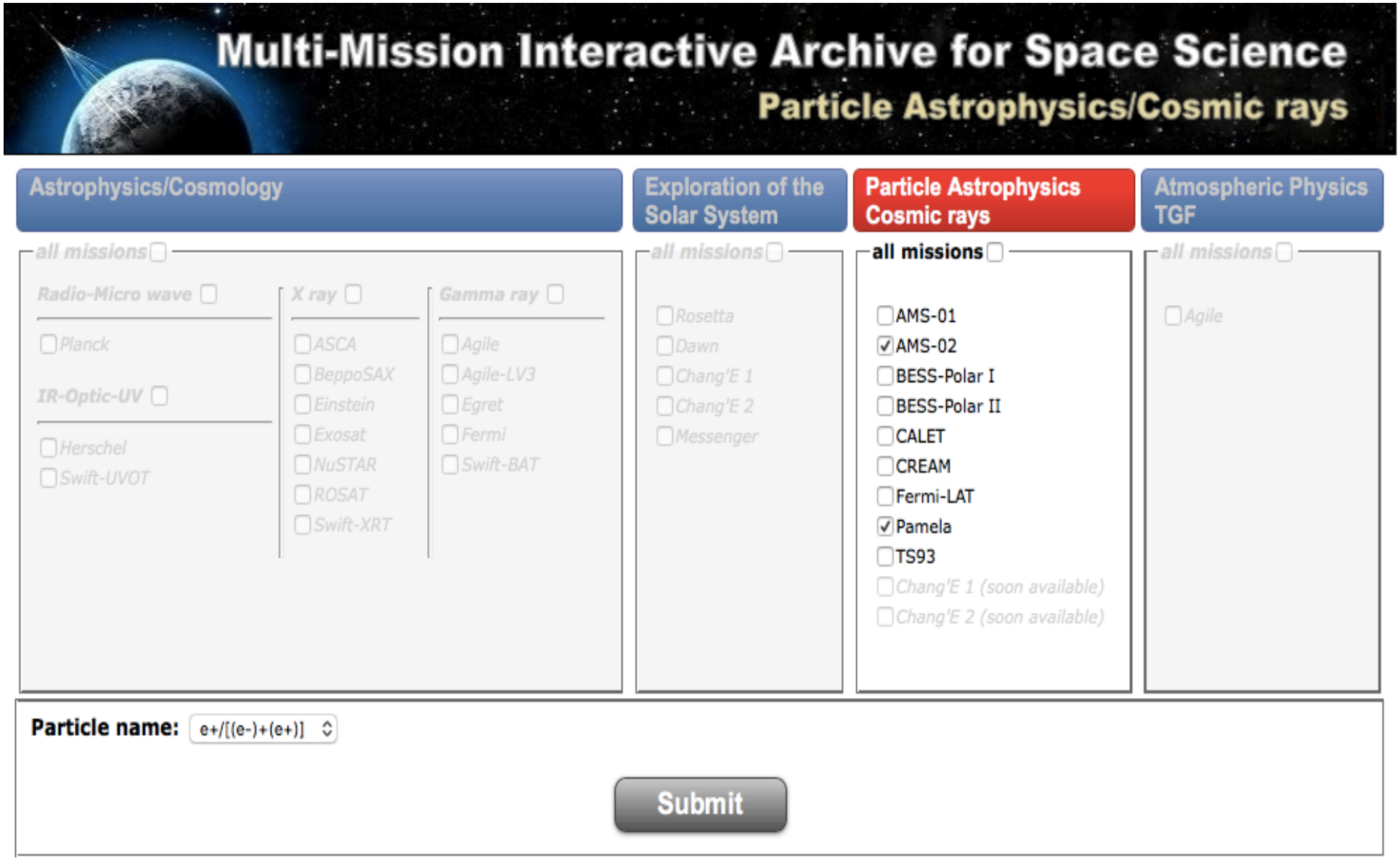
Chang'E 2 (soon available)
all missions
Agile
Target name:
67P Churyumov-Gerasimenko
Submit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Fermi-LAT
Pamela
TS93
Chang'E 1 (soon available)
Chang'E 2 (soon available)
all missions
Agile
Particle name:
e+/[(e-)+(e+)]
Submit

Multi-Mission Interactive Archive for Space Science

Particle Astrophysics/Cosmic rays

Astrophysics/Cosmology | Exploration of the Solar System | Particle Astrophysics Cosmic rays | Atmospheric Physics TGF

all missions

Radio-Micro wave
- Planck

IR-Optic-UV
- Herschel
- Swift-UVOT

X ray
- ASCA
- BeppoSAX
- Einstein
- Exosat
- NuSTAR
- ROSAT
- Swift-XRT

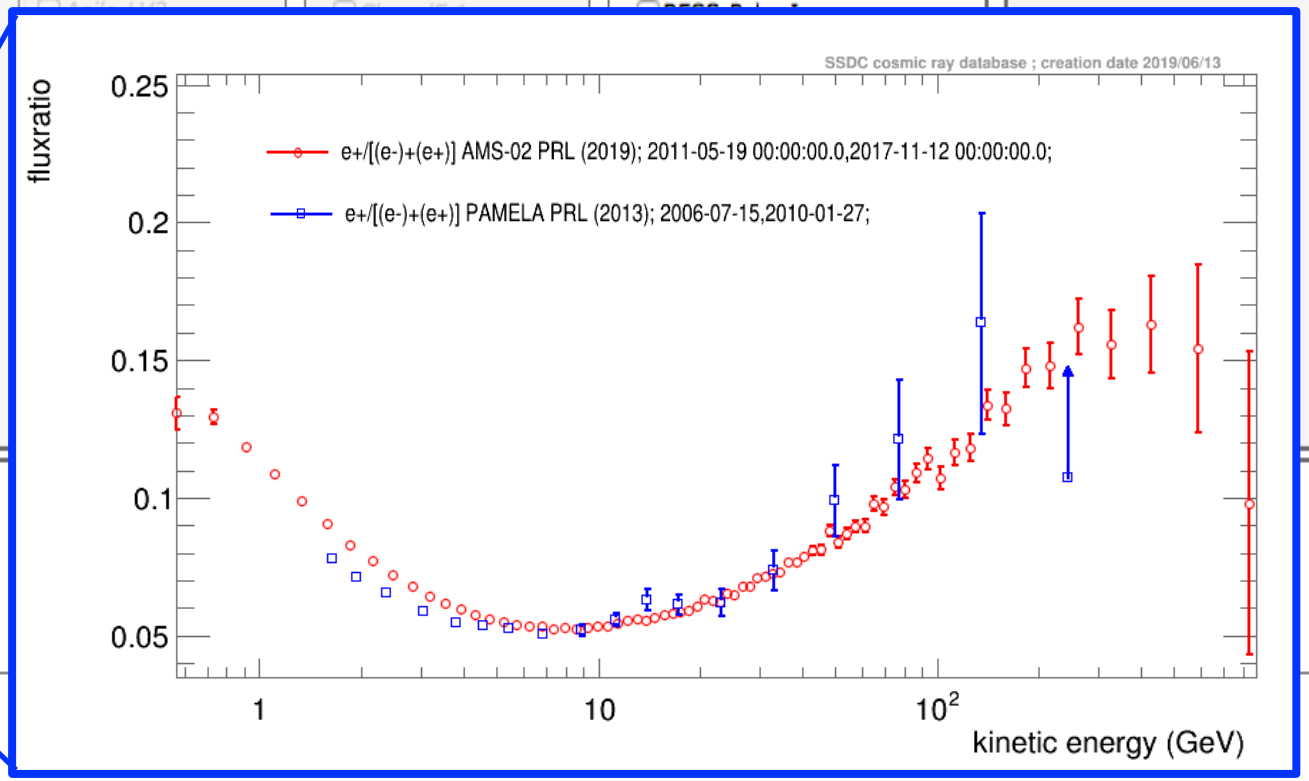
Gamma ray
- Agile

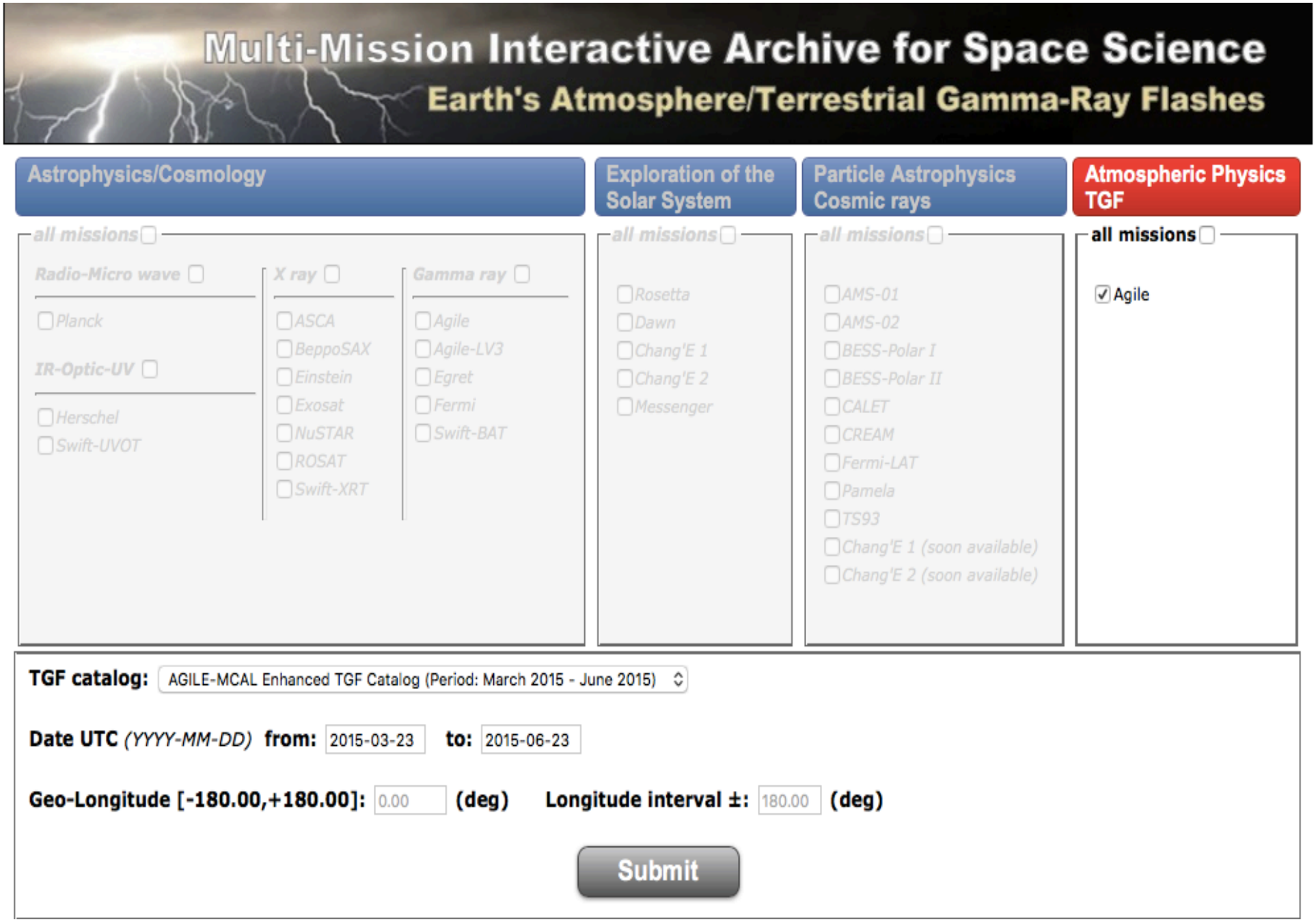
all missions
- Rosetta
- Dawn

all missions
- AMS-01
- AMS-02

all missions
- Agile

Particle name: e+/[(e-)+(e+)]

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Chang'E 2 (soon available)
all missions
Agile
TGF catalog:
AGILE-MCAL Enhanced TGF Catalog (Period: March 2015 - June 2015)
Date UTC (YYYY-MM-DD) from: 2015-03-23 to: 2015-06-23
Geo-Longitude [-180.00,+180.00]: 0.00 (deg) Longitude interval ±: 180.00 (deg)
Submit

Multi-Mission Interactive Archive for Space Science

Earth's Atmosphere/Terrestrial Gamma-Ray Flashes

Astrophysics/Cosmology | Exploration of the Solar System | Particle Astrophysics Cosmic rays | Atmospheric Physics TGF

all missions | all missions | all missions | all missions

Radio-Micro wave | X ray | Gamma ray

Entry number (Selection mode: Include All)		TGF ID	GeoLon	GeoLat	Date (UTC)	Trigger Time T0 (MET in s)	T0_micro (μs)	T50 (ms)	Raw Counts	HR	ML Counts+/-Err
1 Select	TGF LC	150323.96107	119.48	-1.48	2015-03-23T23:03:57	354236637	71008	27	10	9	9.9+/-3.2
2 Select	TGF LC	150324.45177	118.06	1.5	2015-03-24T10:50:33	354279033	734131	67	18	2	18.9+/-4.4
3 Select	TGF LC	150402.21858	119.59	1.7	2015-04-02T05:14:46	355036486	427986	66	12	0.7	10.8+/-3.3
4 Select	TGF LC	150405.44417	118.36	-2.23	2015-04-05T10:39:37	355315177	748350	35	12	5	12.9+/-3.6
5 Select	TGF LC	150410.28321	120.97	-1.93	2015-04-10T06:47:50	355733270	254365	40	11	1.2	11.9+/-3.5
6 Select	TGF LC	150411.75532	118.7	1.94	2015-04-11T18:07:40	355860460	609292	175	20	2.3	20.4+/-4.6
7 Select	TGF LC	150422.62361	121.22	2.41	2015-04-22T14:58:00	356799480	476284	31	12	1.4	11.9+/-3.5

TGF catalog: AGILE-MCAL Enhanced TGF Catalog (Period: March 2015 - June 2015)

Date UTC *(YYYY-MM-DD)* **from:** 2015-03-23 **to:** 2015-06-23

Geo-Longitude [-180.00,+180.00]: 0.00 **(deg)** **Longitude interval ±:** 180.00 **(deg)**

Submit

Multi-Mission Interactive Archive for Space Science

Earth's Atmosphere/Terrestrial Gamma-Ray Flashes

Astrophysics/Cosmology

all missions

Radio-Micro wave | X ray | Gamma ray

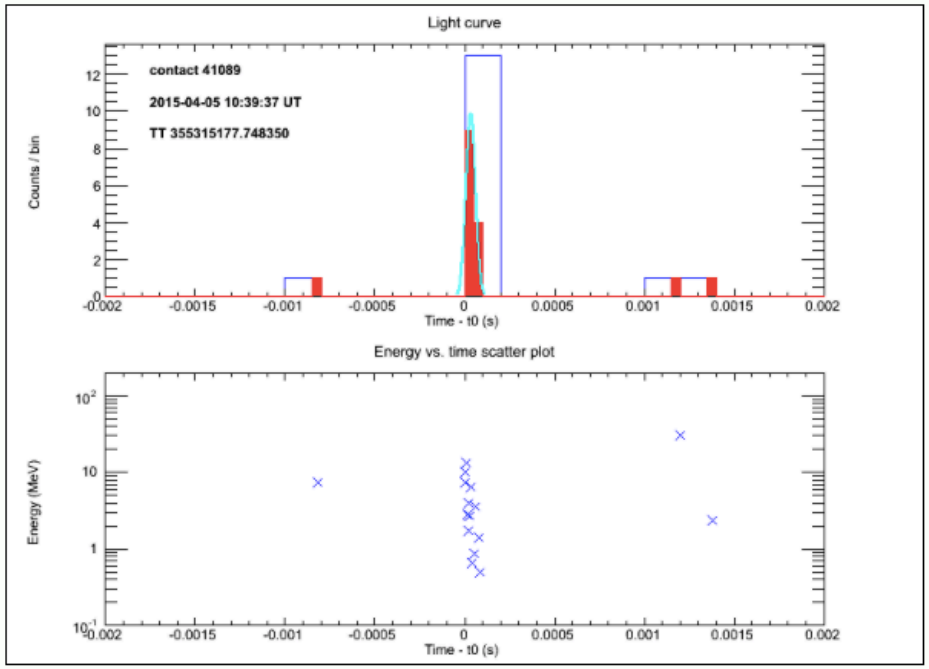
Entry number		TGF ID	GeoLon	GeoLat	Date
Selection mode: Include All		Stats	Stats	Stats	
1 Select	TGF LC	150323.96107	119.48	-1.48	2015-03-
2 Select	TGF LC	150324.45177	118.06	1.5	2015-03-
3 Select	TGF LC	150402.21858	119.59	1.7	2015-04-
4 Select	TGF LC	150405.44417	118.36	-2.23	2015-04-
5 Select	TGF LC	150410.28321	120.97	-1.93	2015-04-
6 Select	TGF LC	150411.75532	118.7	1.94	2015-04-
7 Select	TGF LC	150422.62361	121.22	2.41	2015-04-

AGILE MCAL Data Products | Source Details

Standard Products

Light Curve Legend:

Blue histogram: 200 microsec time bin
Red filled histogram: finer binning 50 microsec
Cyan curve: maximum likelihood Gaussian fit



TGF catalog: AGILE-MCAL Enhanced TGF Catalog (Period: March

Date UTC *(YYYY-MM-DD)* **from:** 2015-03-23 **to:** 2015-

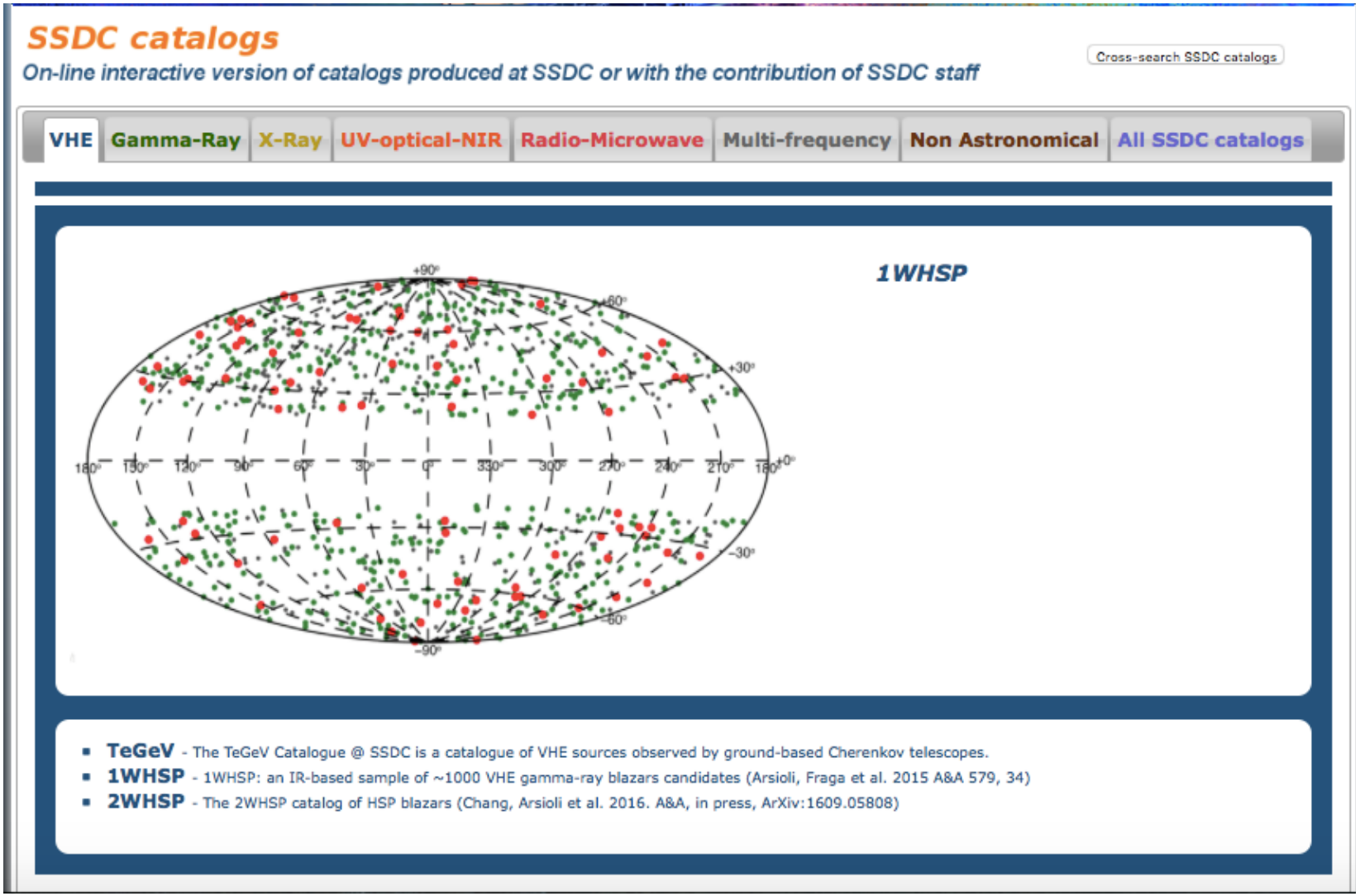
Geo-Longitude [-180.00,+180.00]: 0.00 **(deg)** **Longitude interval ±:** 180.00 **(deg)**

Submit

THE SSDC RESIDENT CATALOGS

ALL SSDC SOURCE CATALOGS

MULTI-BAND AND MULTI-FREQUENCY CAT.



MULTI-BAND AND MULTI-FREQUENCY CAT.

SSDC catalogs

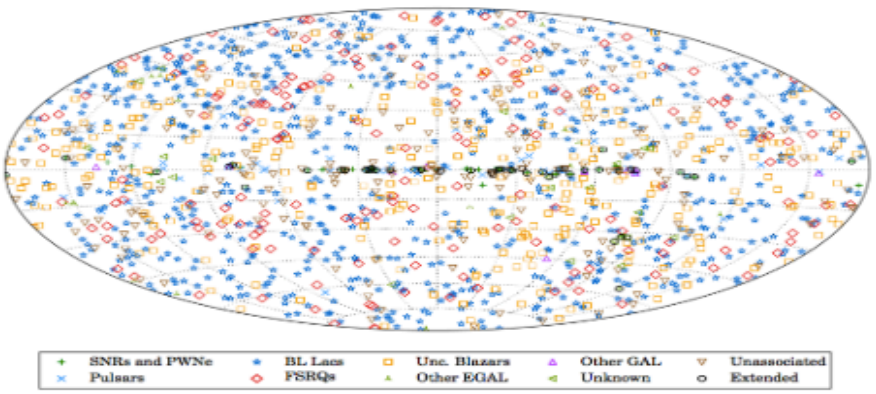
On-line interactive version of catalogs produced at SSDC or with the contribution of SSDC staff

Cross-search SSDC catalogs

VHE | Gamma-Ray | X-Ray | UV-optical-NIR | Radio-Microwave | Multi-frequency | Non Astronomical | All SSDC catalogs

Fermi

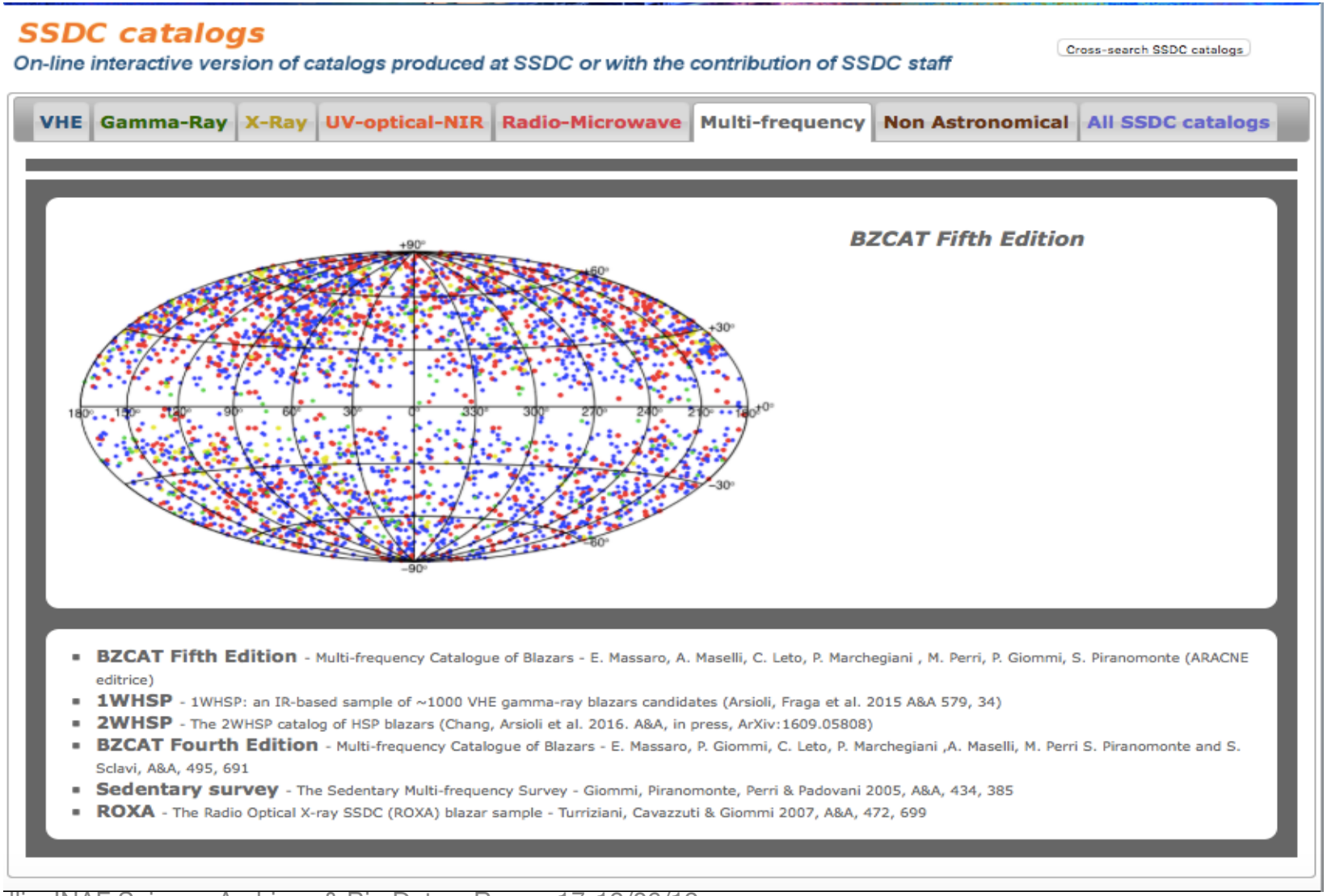
Fermi 3FHL



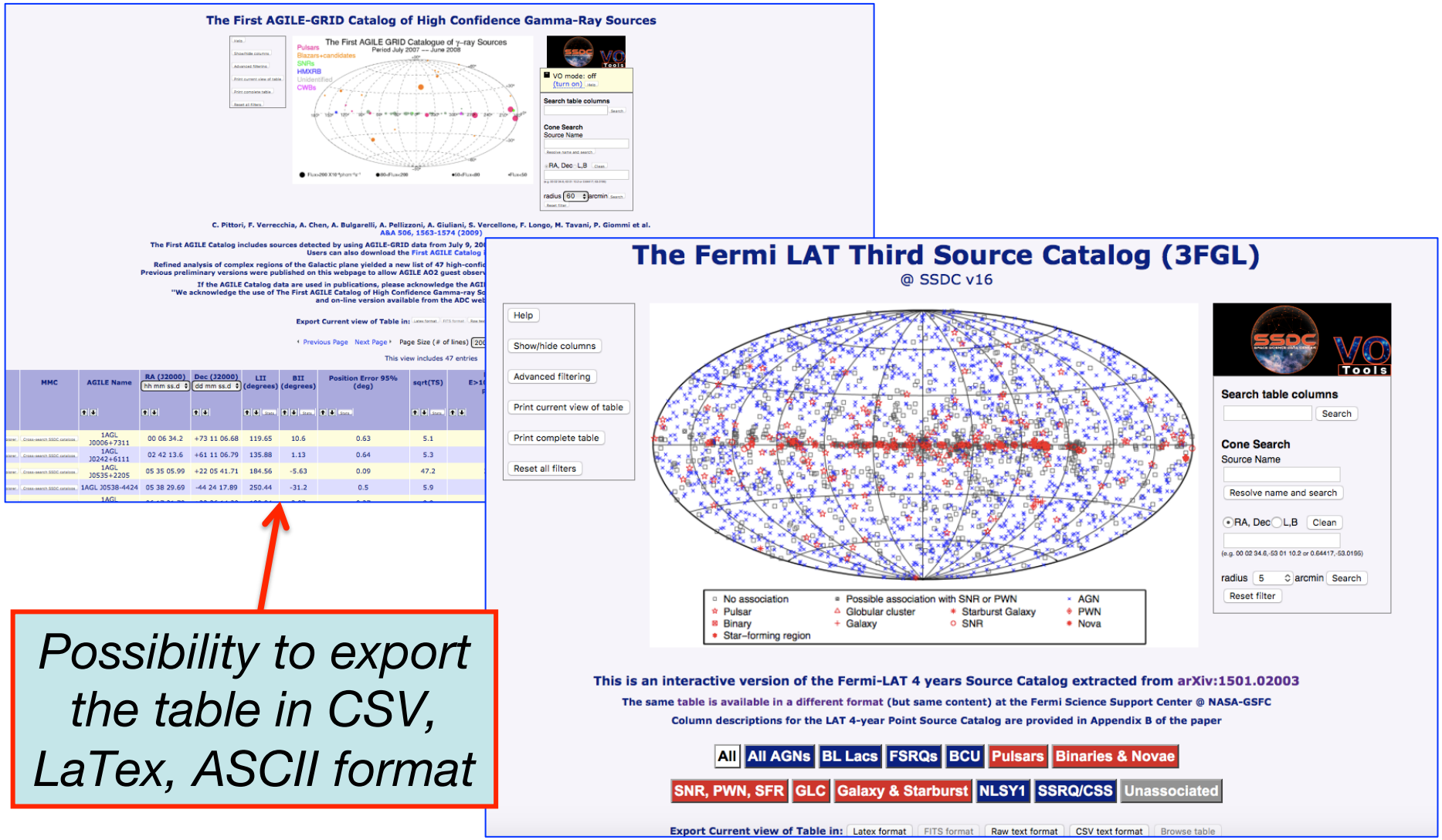
- **Fermi 1FLE** - The First Fermi-LAT Catalog of Sources below 100MeV (Principe, Malyshev, Ballet, Funk, A&A 618, 22, 2018)
- **Fermi 3FHL** - The Third Fermi LAT Catalog of High energy Sources
- **Fermi 2FHL** - The Second Fermi LAT Catalog of High energy Sources
- **Fermi 3LAC** - The 3rd Catalog of AGN Detected by the Fermi LAT (Ackermann, Ajello et al. arXiv:1501.06054)
- **Fermi 3FGL** - Fermi Large Area Telescope Third Source Catalog (Acero, Ackermann et al. arXiv:1501.02003)
- **Fermi 2LAC** - The 2 Year Fermi-LAT AGN Catalog (Ackermann, Ajello, Allafort et al. 2011, ApJ, 743, 171)
- **Fermi 2FGL** - The 2 Year Fermi-LAT Sources Catalog (Nolan, Abdo, Ackermann et al. 2012, ApJS, 199, 31)
- **Fermi 1LAC** - The 1 Year Fermi-LAT AGN Catalog (Abdo, Ackermann, Ajello et al. 2010, ApJ, 715, 429)
- **Fermi 1FGL** - The 1 Year Fermi-LAT Sources Catalog (Abdo, Ackermann, Ajello et al. 2010, ApJS, 188, 405)

AGILE

MULTI-BAND AND MULTI-FREQUENCY CAT.

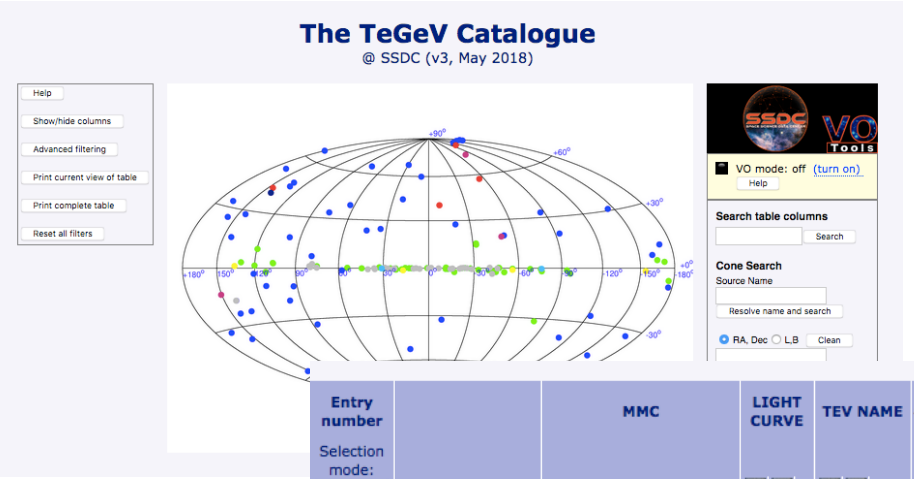


ACCESS TO SSDC MISSION CATALOGS



Possibility to export the table in CSV, LaTex, ASCII format

SSDC CATALOGS: I/F WITH SSDC SERVICES



Entry number Selection mode: Include All		MMC	LIGHT CURVE	TEV NAME	# OBS.	OTHER NAMES	TYPE	RA (J2000) hh mm ss	Dec (J2000) dd mm ss	INTEGRAL FLUX x E-12 cm2/s Stats	THR ENERGY [GeV] Stats
1 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0006+7259	1	CTA 1/ G 119.5+10.2	PWN/SNR	00 06 26	+72 59 01	-	-
2 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0013-1853	1	SHBL J001355.9-185406	HBL	00 13 52.0	-18 53 29	0.83	310
3 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0025+6410	1	Tycho SNR	SNR	00 25 27.0	+64 10 50	0.187	1000
4 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0033-1921	1	KUV 00311-1938/RBS 0076/1RXS J003334.6-192130	HBL	00 33 34.2	-19 21 33.3	-	-
5 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0035+5947	1	1ES 0033+595	HBL	00 35 16.8	+59 47 24.0	7.1	150
6 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0047-2517	2	NGC 253	Starburst	00 47 34.3	-25 17 22.6	0.56	190
7 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0136+3905	1	RGB J0136+391/B3 0133+388/1RXS J013632.9+390556	HBL	01 36 32.5	+39 05 59.6	-	-
8 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0152+0146	1	RGB J0152+017/RXJ0152.6+0147	HBL	01 52 33.5	+01 46 40.3	2.7	300
9 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0205+6451	1	3C 58	PWN	02 05 31	+64 51 00	0.14	1000
10 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J0221+3556	1	S3 0218+35/ B2 0218+35	Blazar	02 21 05.5	+35 56 13.7	-	100

LINK TO SSDC MWL TOOLS

134 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1912+1009	1	HESS J1912+101/ PSR J1913+1011	PW
135 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1922+1411	4	HESS J1923+141/ W 51C/ G49.2-0.7	SNR
136 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1930+1852	1	VER J1930+188/ G 54.1+0.3/ PSR J1930+1852	PWN/
137 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1943+2118	1	HESS J1943+213	HE
138 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1959+6508	3	1ES 1959+650	HE
139 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J2001+4353	1	MAGIC J2001+435	IE
140 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J2009-4849	2	PKS 2005-489	HE
141 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J2016+3711	1	VER J2016+371/ CTB 87	PWN/
142 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J2018+3642	4	MGRO J2019+37	PWN/

LINK TO SSDC MWL TOOLS

134 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1912+1009	1	HESS J1912+101/ PSR J1913+1011	PW
135 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1922+1411	4	HESS J1923+141/ W 51C/ G49.2-0.7	SNR
136 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1930+1852	1	VER J1930+188/ G 54.1+0.3/ PSR J1930+1852	PWN/
137 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J1943+2118	1	HESS J1943+213	HE
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141 Select	SSDC Data Explorer	Cross-search SSDC catalogs	-	TeV J2016+3711	1	VER J2016+371/ CTB 87	PWN/
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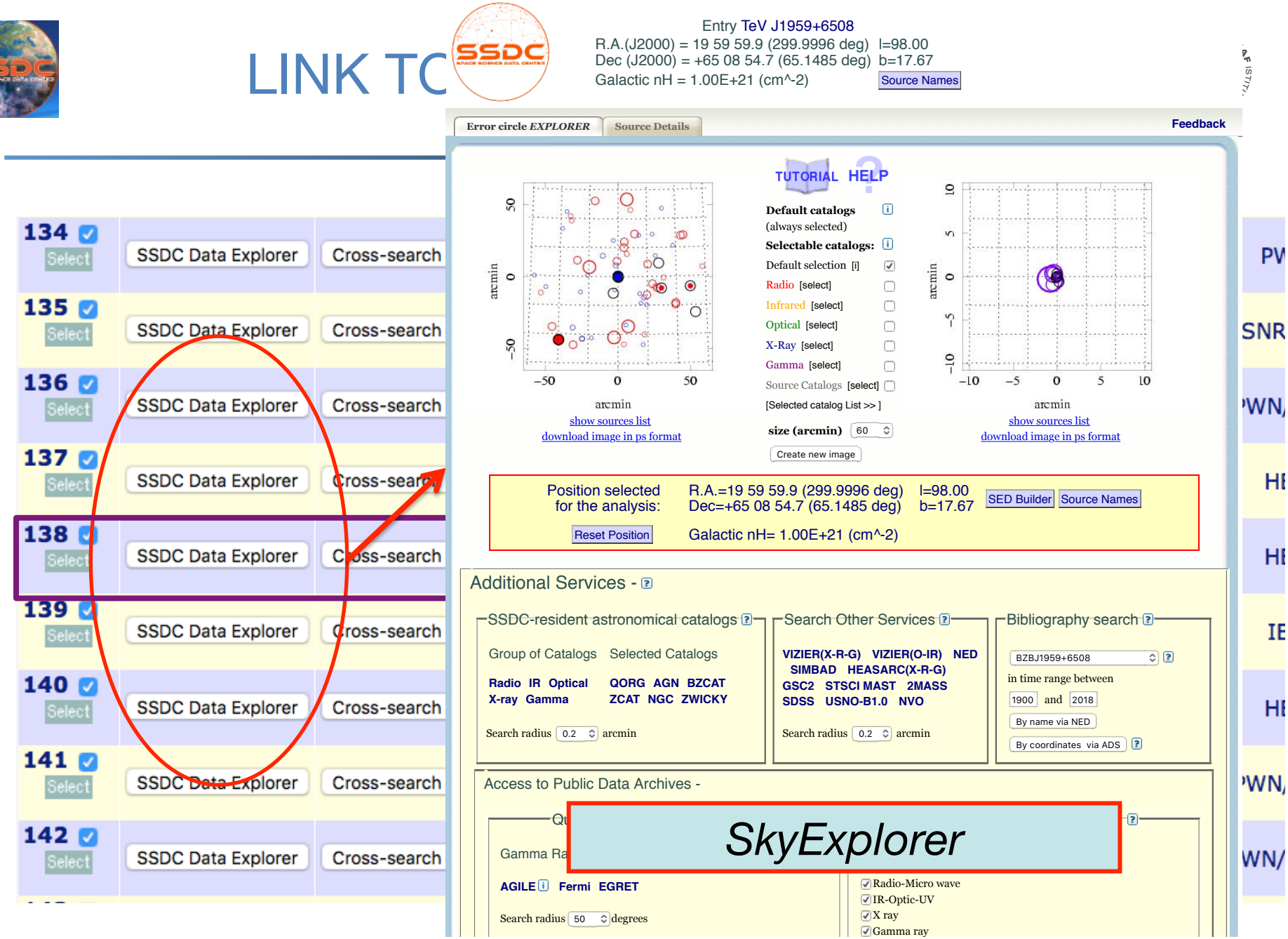
LINK TO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R.A.(J2000) = 19 59 59.9 (299.9996 deg) l=98.00
Dec (J2000) = +65 08 54.7 (65.1485 deg) b=17.67
Galactic nH = 1.00E+21 (cm^-2)
Source Names
Error circle EXPLORER
Source Details
Feedback
TUTORIAL HELP
Default catalogs
(always selected)
Selectable catalogs:
Default selection [i]
Radio [select]
Infrared [select]
Optical [select]
X-Ray [select]
Gamma [select]
Source Catalogs [select]
[Selected catalog List >>]
size (arcmin) 60
Create new image
arcmin
show sources list
download image in ps format
Position selected for the analysis:
R.A.=19 59 59.9 (299.9996 deg) l=98.00
Dec=+65 08 54.7 (65.1485 deg) b=17.67
SED Builder
Source Names
Reset Position
Galactic nH= 1.00E+21 (cm^-2)
Additional Services -
SSDC-resident astronomical catalogs
Group of Catalogs
Selected Catalogs
Radio IR Optical
X-ray Gamma
QORG AGN BZCAT
ZCAT NGC ZWICKY
Search radius 0.2 arcmin
Search Other Services
VIZIER(X-R-G) VIZIER(O-IR) NED
SIMBAD HEASARC(X-R-G)
GSC2 STSCI MAST 2MASS
SDSS USNO-B1.0 NVO
Search radius 0.2 arcmin
Bibliography search
BZBJ1959+6508
in time range between
1900 and 2018
By name via NED
By coordinates via ADS
Access to Public Data Archives -
SkyExplorer
AGILE Fermi EGRET
Search radius 50 degrees
Radio-Micro wave
IR-Optic-UV
X ray
Gamma ray
134 Select SSDC Data Explorer Cross-search
135 Select SSDC Data Explorer Cross-search
136 Select SSDC Data Explorer Cross-search
137 Select SSDC Data Explorer Cross-search
138 Select SSDC Data Explorer Cross-search
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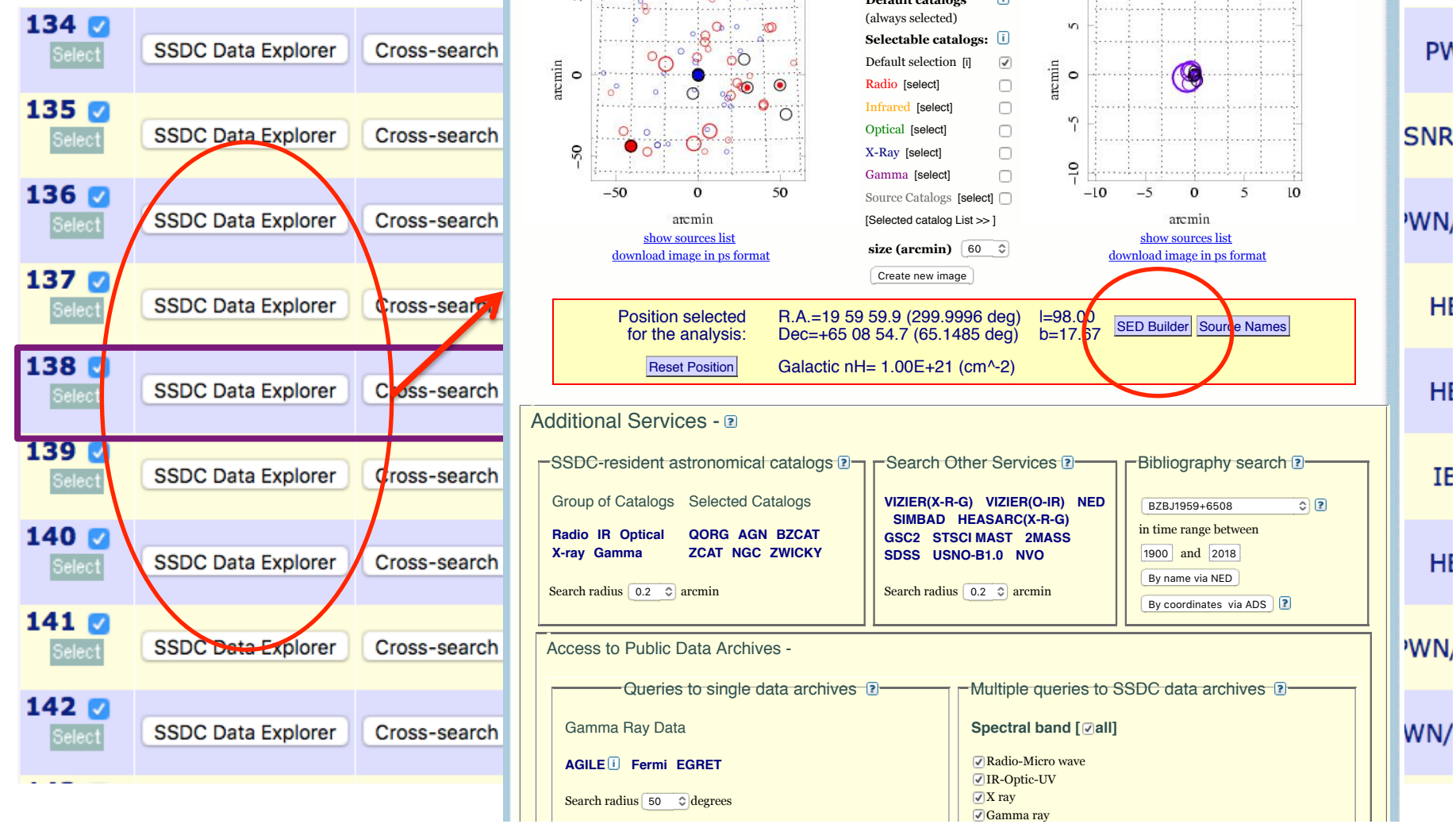
LINK TO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R.A.(J2000) = 19 59 59.9 (299.9996 deg) l=98.00
Dec (J2000) = +65 08 54.7 (65.1485 deg) b=17.67
Galactic nH = 1.00E+21 (cm^-2)
Source Names
Error circle EXPLORER
Source Details
Feedback
TUTORIAL HELP
Default catalogs
(always selected)
Selectable catalogs:
Default selection [i]
Radio [select]
Infrared [select]
Optical [select]
X-Ray [select]
Gamma [select]
Source Catalogs [select]
[Selected catalog List >>]
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Create new image
arcmin
show sources list
download image in ps format
Position selected for the analysis:
R.A.=19 59 59.9 (299.9996 deg) l=98.00
Dec=+65 08 54.7 (65.1485 deg) b=17.67
Galactic nH= 1.00E+21 (cm^-2)
Reset Position
SED Builder
Source Names
Additional Services -
SSDC-resident astronomical catalogs
Group of Catalogs
Selected Catalogs
Radio IR Optical
X-ray Gamma
QORG AGN BZCAT
ZCAT NGC ZWICKY
Search radius 0.2 arcmin
Search Other Services
VIZIER(X-R-G) VIZIER(O-IR) NED
SIMBAD HEASARC(X-R-G)
GSC2 STSCI MAST 2MASS
SDSS USNO-B1.0 NVO
Search radius 0.2 arcmin
Bibliography search
BZBJ1959+6508
in time range between
1900 and 2018
By name via NED
By coordinates via ADS
Access to Public Data Archives -
Queries to single data archives
Gamma Ray Data
AGILE Fermi EGRET
Search radius 50 degrees
Multiple queries to SSDC data archives
Spectral band [all]
Radio-Micro wave
IR-Optic-UV
X ray
Gamma ray
134 Select SSDC Data Explorer Cross-search
135 Select SSDC Data Explorer Cross-search
136 Select SSDC Data Explorer Cross-search
137 Select SSDC Data Explorer Cross-search
138 Select SSDC Data Explorer Cross-search
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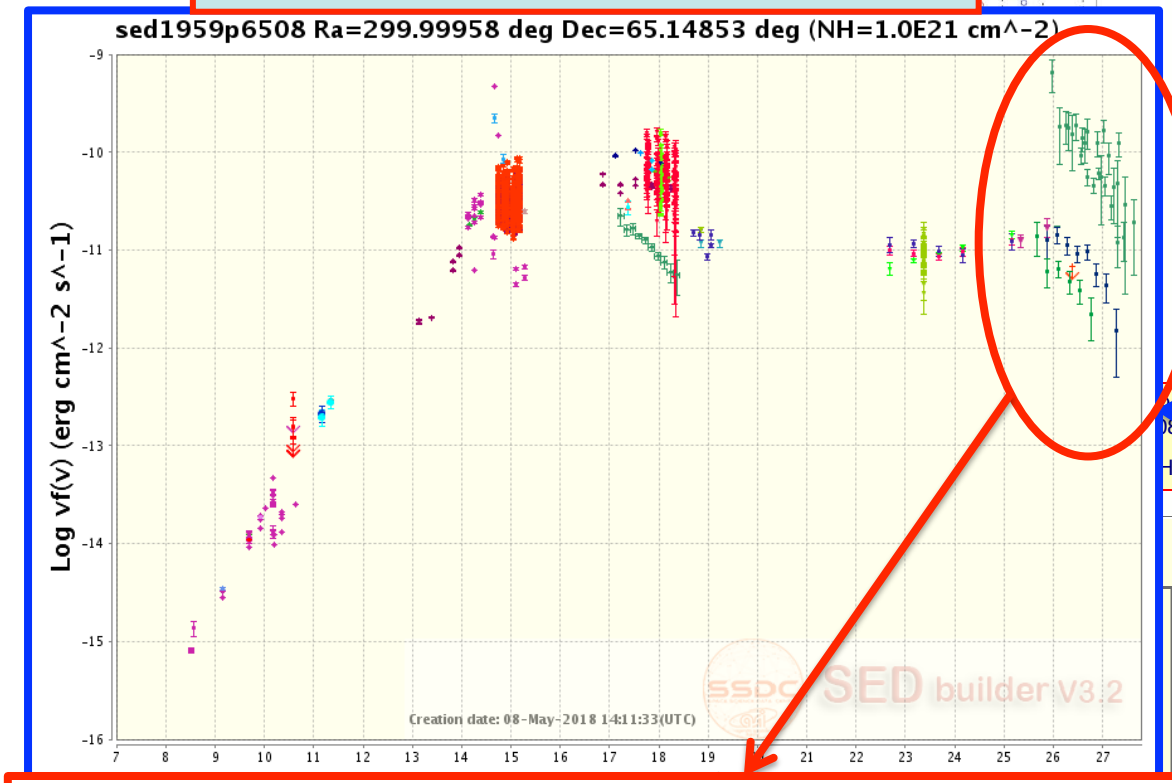
140 Select SSDC Data Explorer Cross-search
141 Select SSDC Data Explorer Cross-search
142 Select SSDC Data Explorer Cross-search

LINK TC

Entry TeV J1959+6508
R.A.(J2000) = 19 59 59.9 (299.9996 deg) l=98.00
Dec (J2000) = +65 08 54.7 (65.1485 deg) b=17.67
Galactic nH = 1.00E+21 (cm^-2)
Source Names

Error circle *EXPLORER* | Source Details | Feedback

SEDBuilder



TUTORIAL HELP

Default catalogs
(always selected)
Selectable catalogs:
Default selection [i]
Radio [select]
Infrared [select]
Optical [select]
X-ray [select]
Gamma [select]
Source Catalogs [select]
[Selected catalog List >>]
size (arcmin) 60
Create new image

arcmin
show sources list
download image in ps format

9.9 (299.9996 deg) l=98.00
08 54.7 (65.1485 deg) b=17.67
H= 1.00E+21 (cm^-2)
SED Builder | Source Names

Search Other Services
VIZIER(X-R-G) VIZIER(O-IR) NED
SIMBAD HEASARC(X-R-G)
GSC2 STSCI MAST 2MASS
SDSS USNO-B1.0 NVO
Search radius 0.2 arcmin

Bibliography search
BZBJ1959+6508
in time range between
1900 and 2018
By name via NED
By coordinates via ADS

Archival data from WHIPPLE, HEGRA, MAGIC, VERITAS

142 Select | SSDC Data Explorer | Cross-search

Queries to single data archives
Gamma Ray Data
AGILE Fermi EGRET
Search radius 50 degrees

Multiple queries to SSDC data archives
Spectral band [all]
Radio-Micro wave
IR-Optic-UV
X ray
Gamma ray

SOME SSDC “USE CASES”

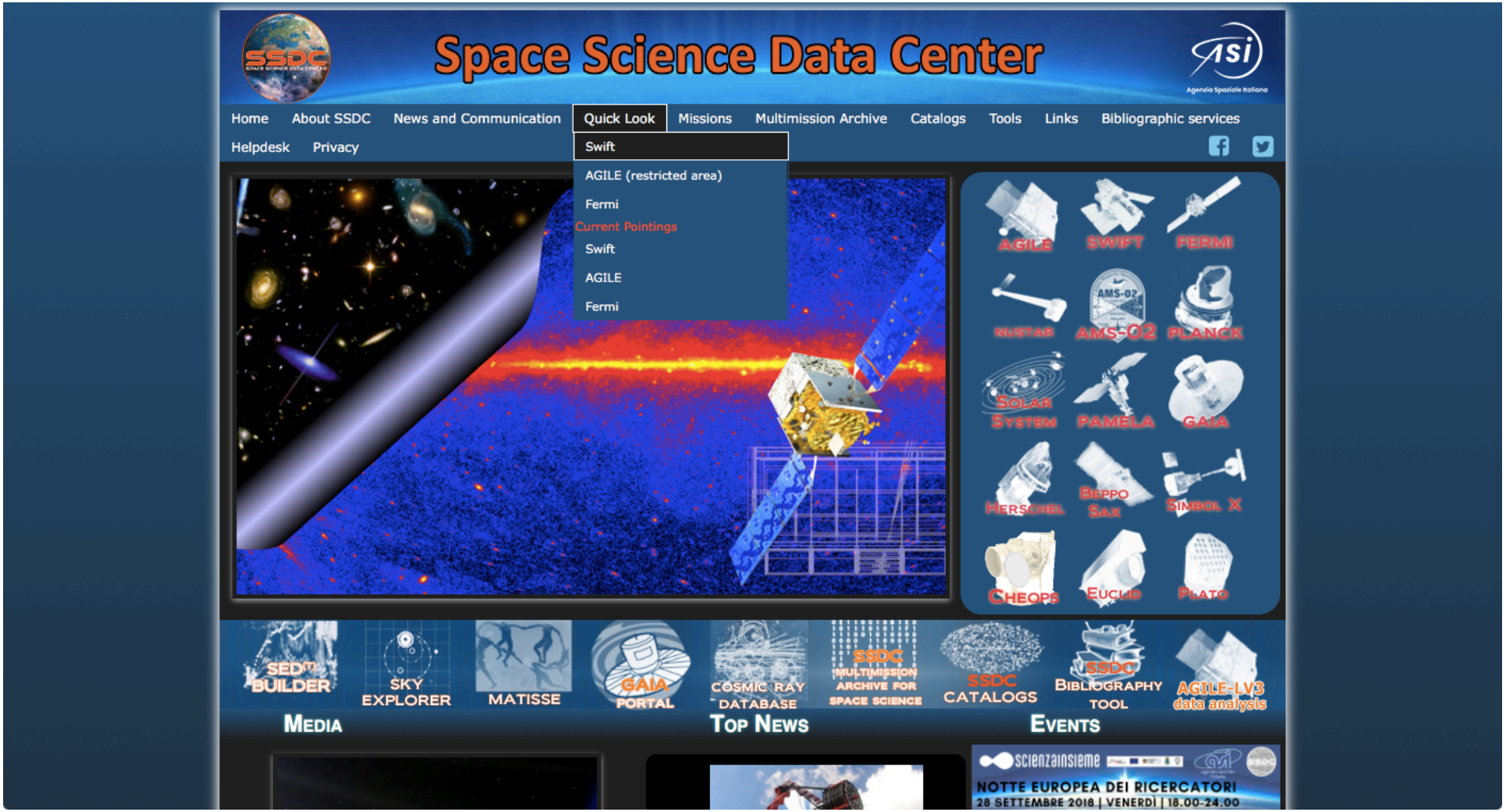
SOME SSDC “USE CASES”

- MWL *Quick Look* data analysis
- SED modelization/classification of blazar AGNs
- Search for EM counterparts of IceCube neutrino events

MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

SWIFT-XRT data –



MWL QL MONITORING OF PKS 1830-211

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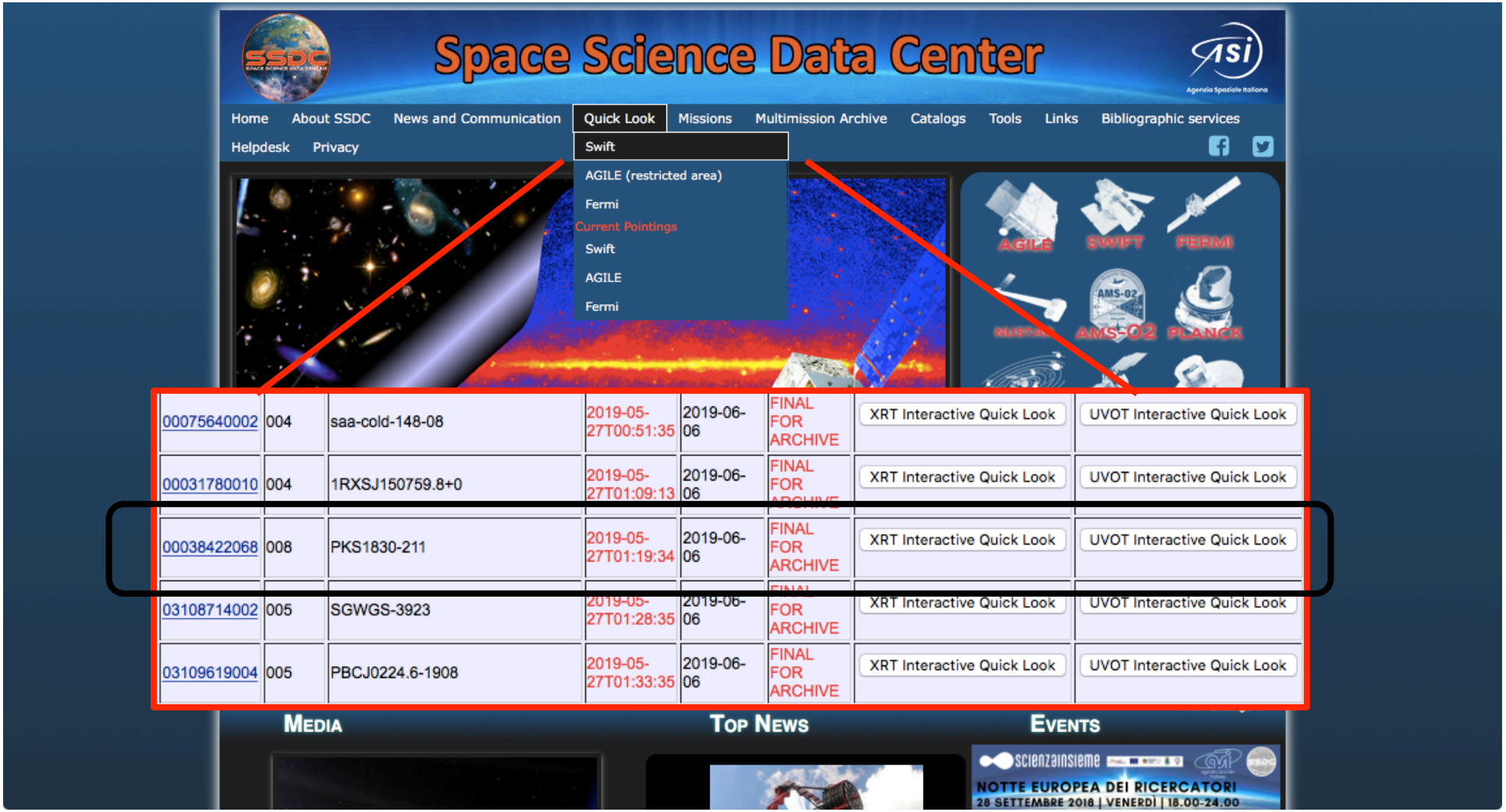

MWL QL MONITORING OF PKS 1830-211

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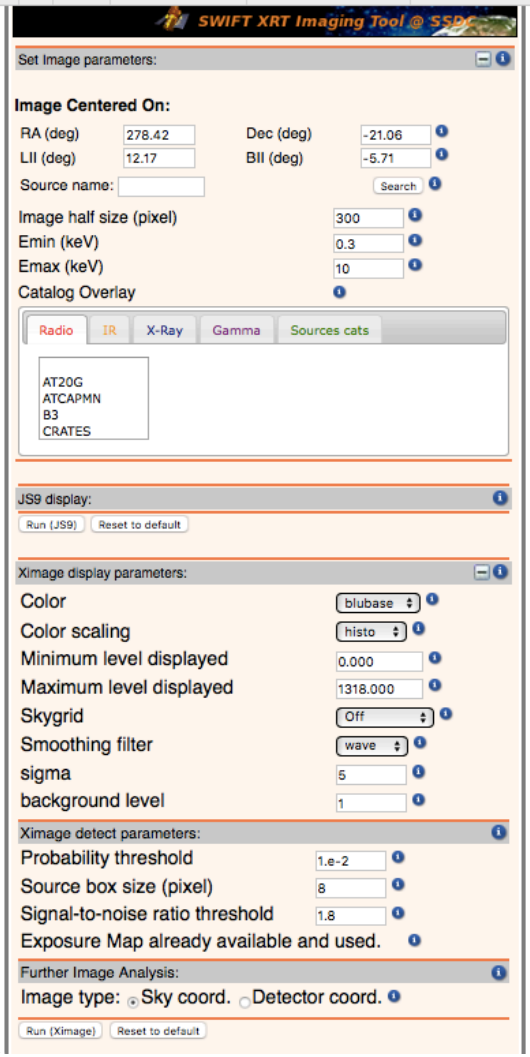

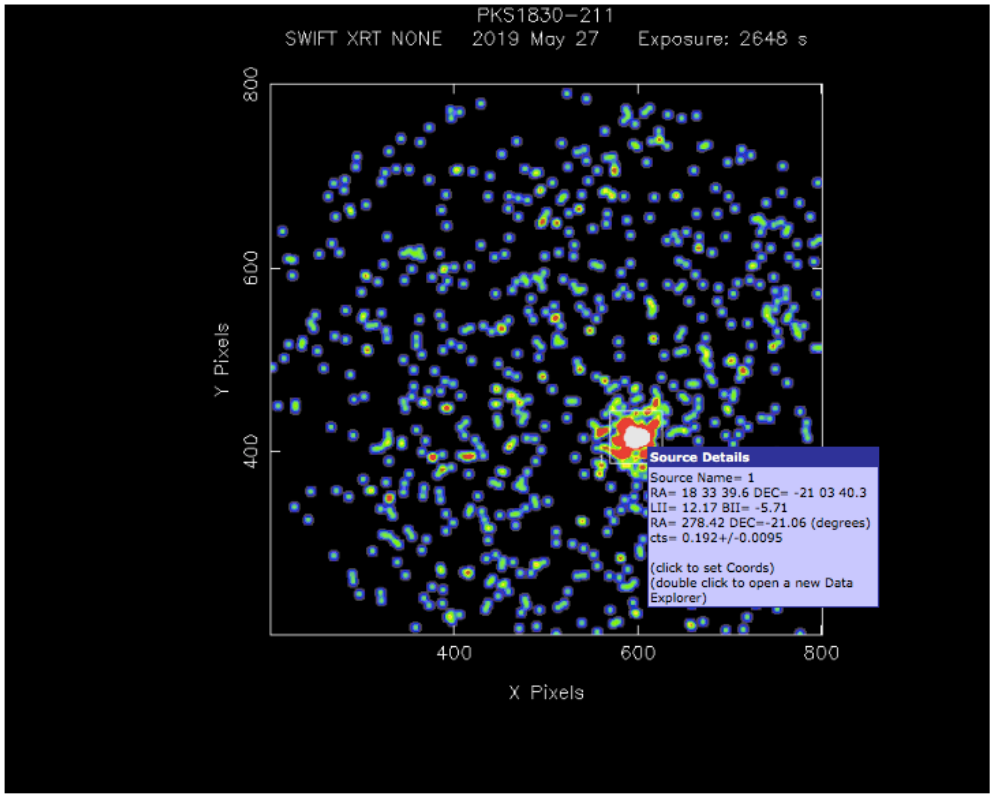

MWL QL MONITORING OF PKS 1830-211

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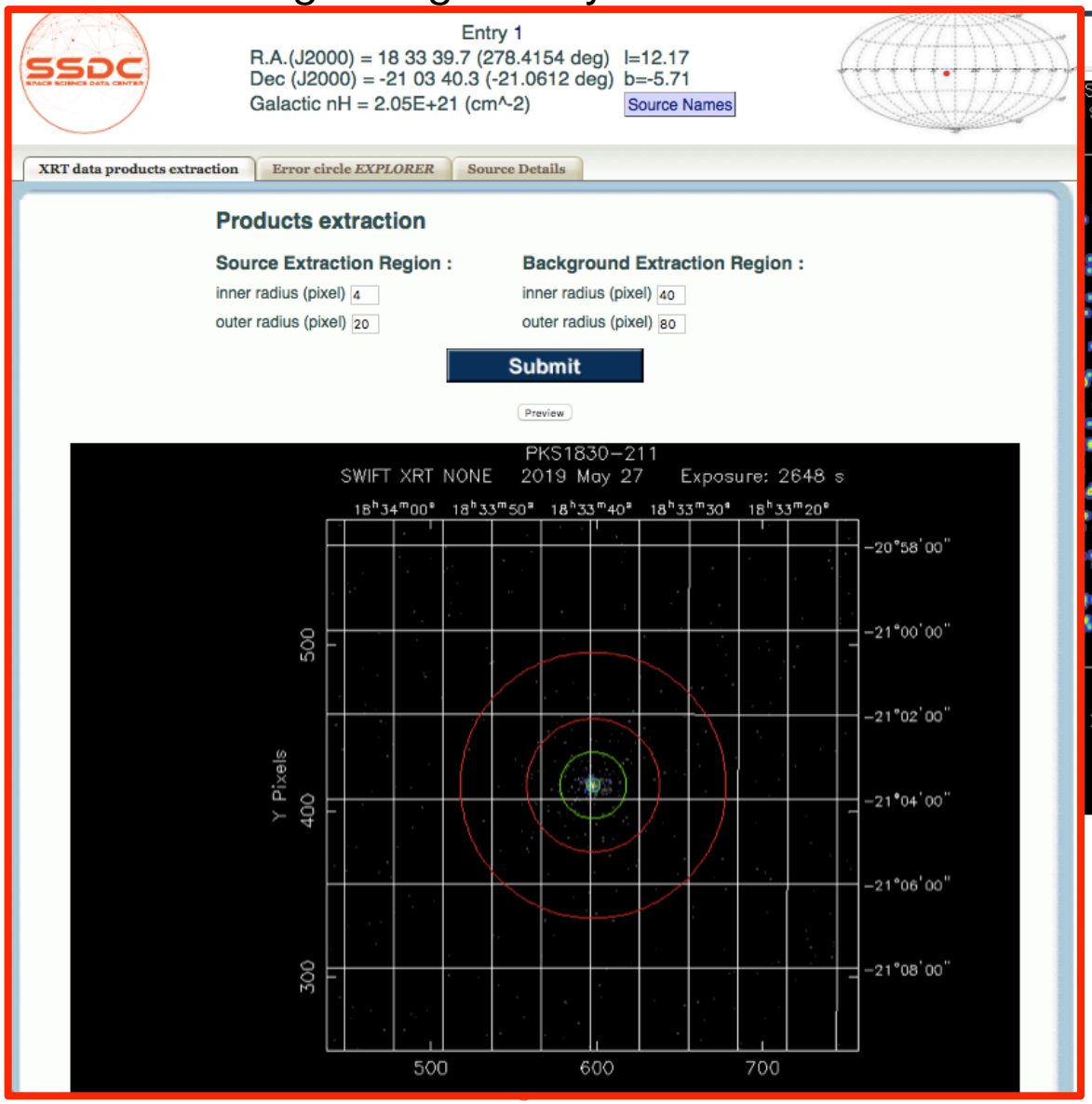

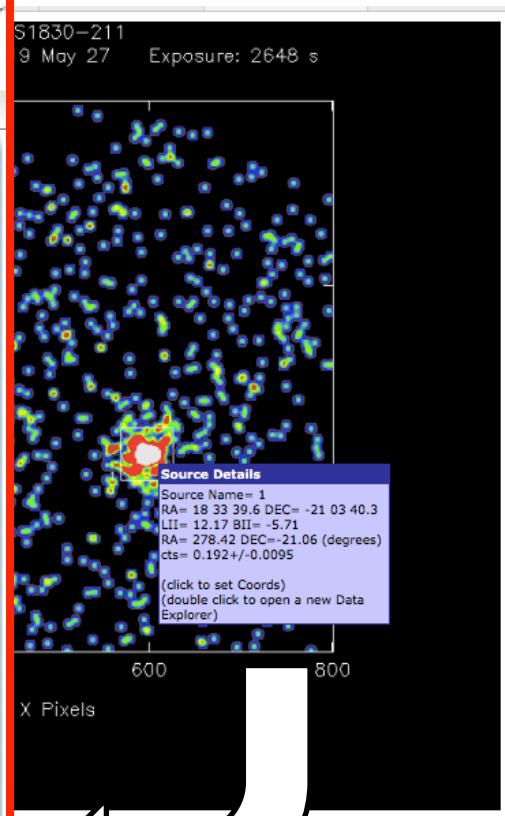

MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

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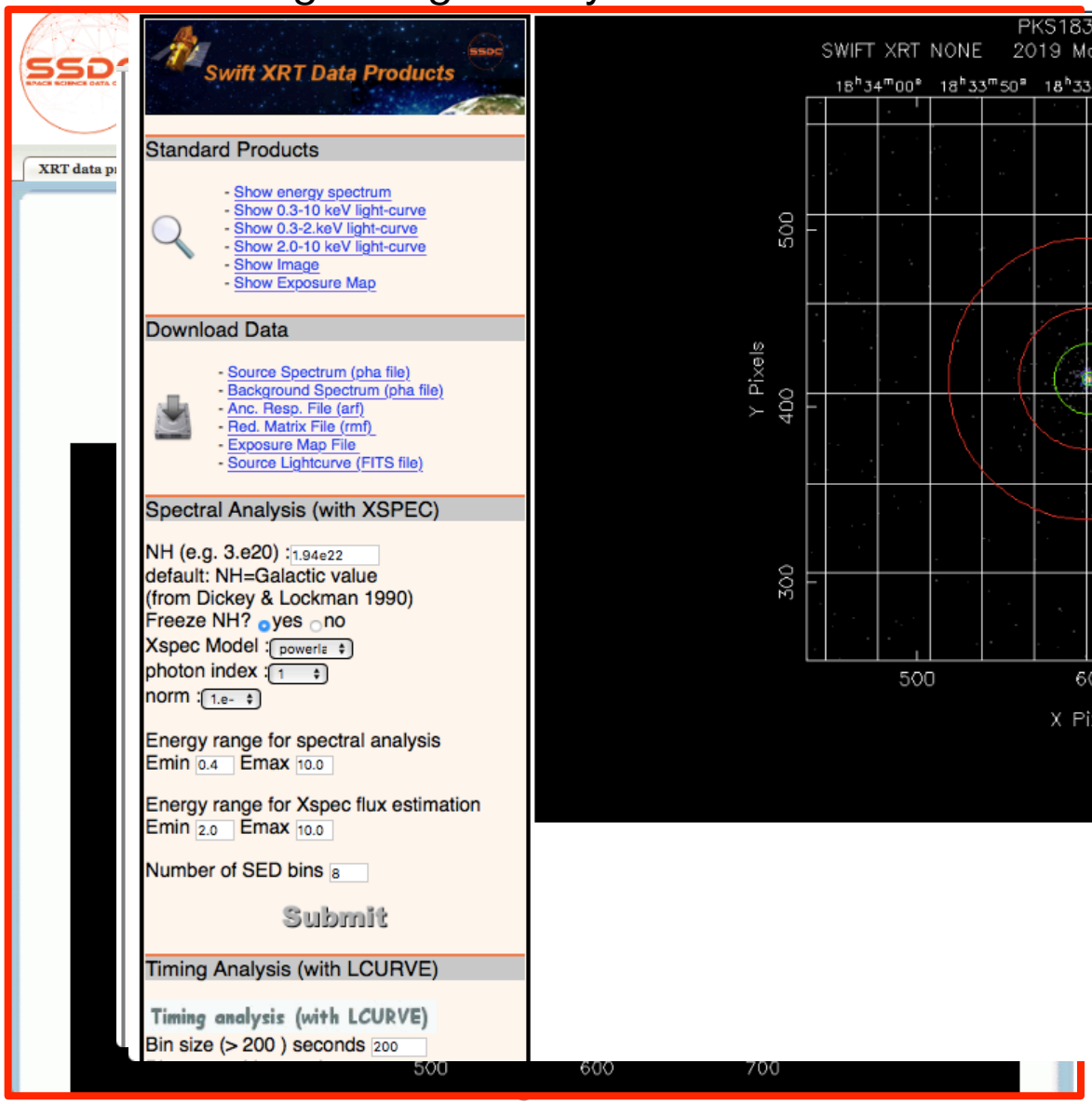

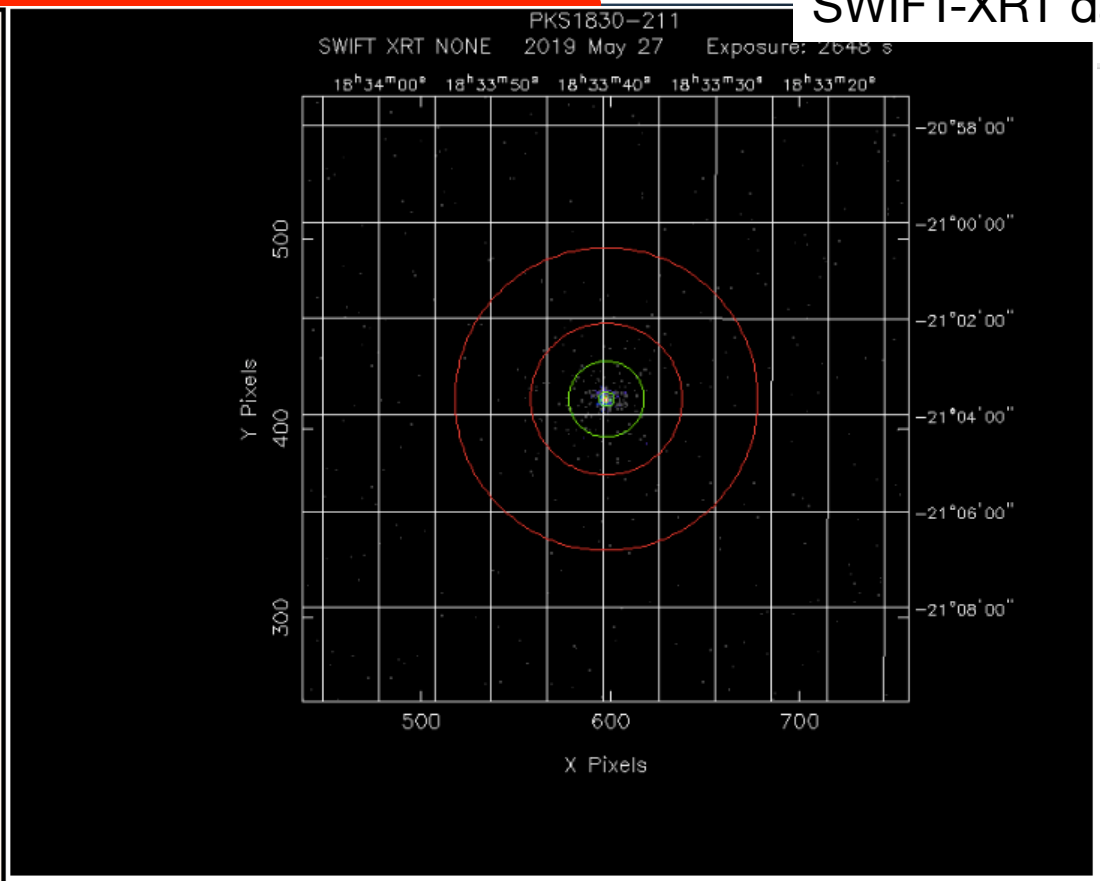

MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

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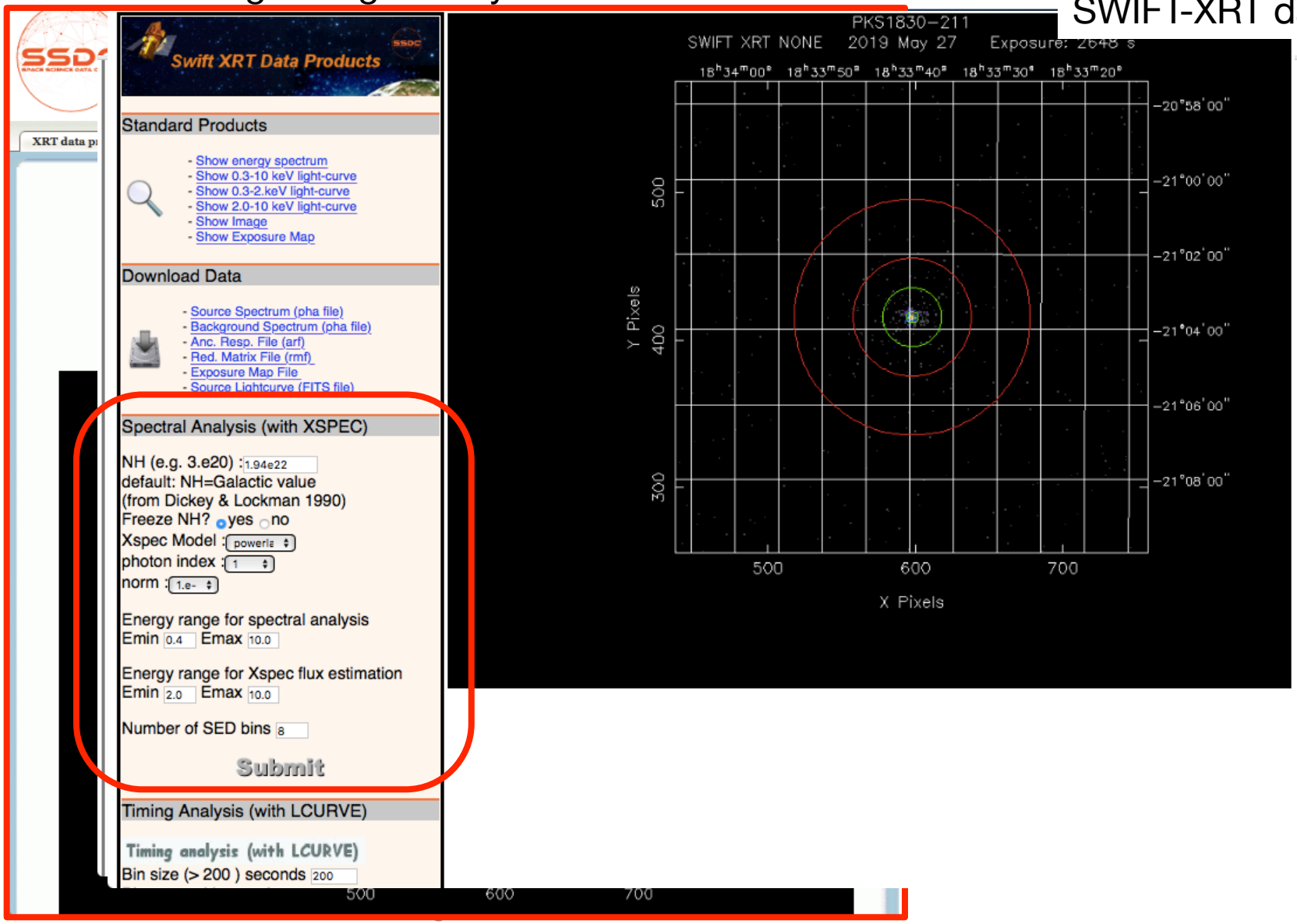

MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

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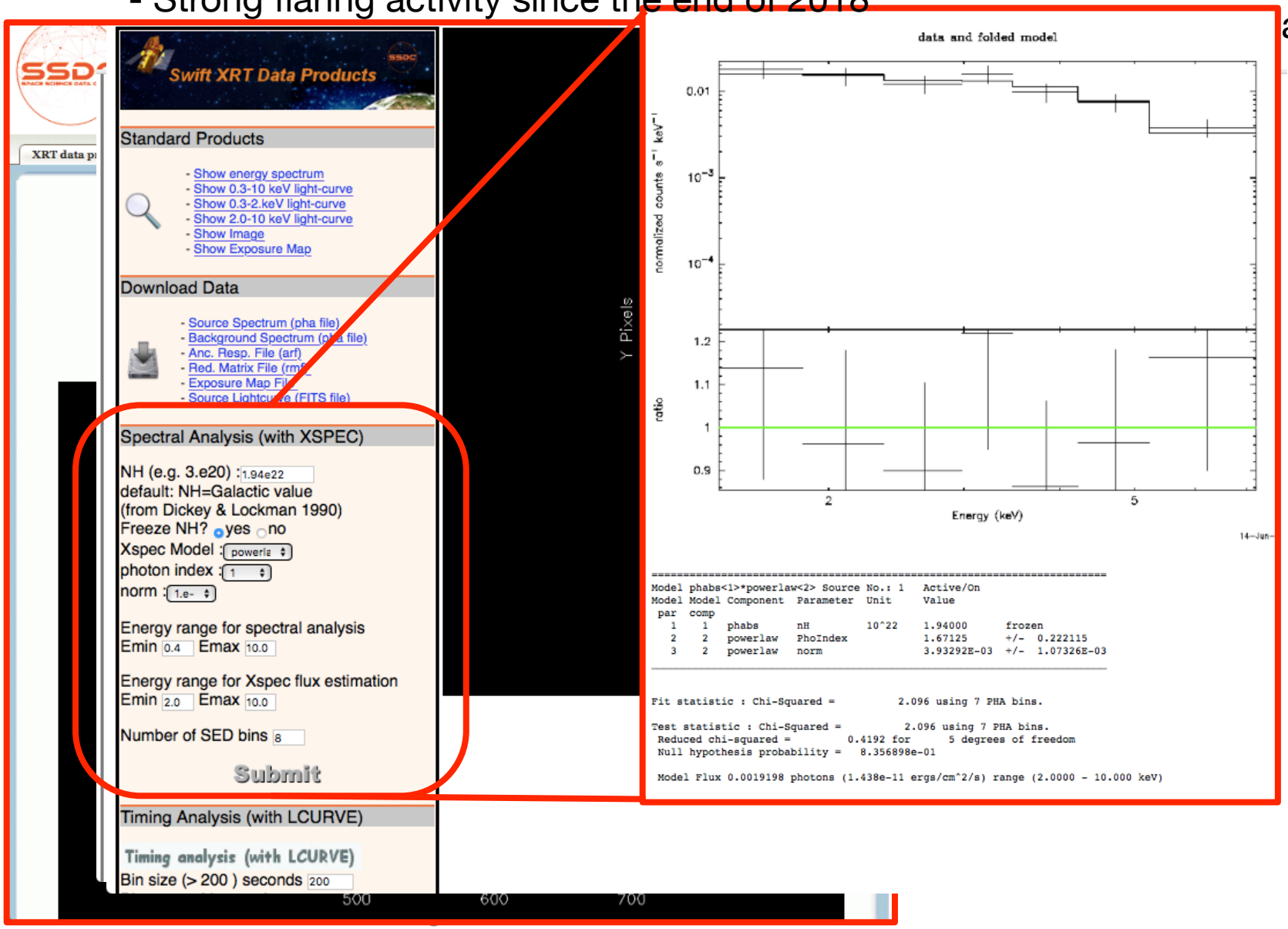
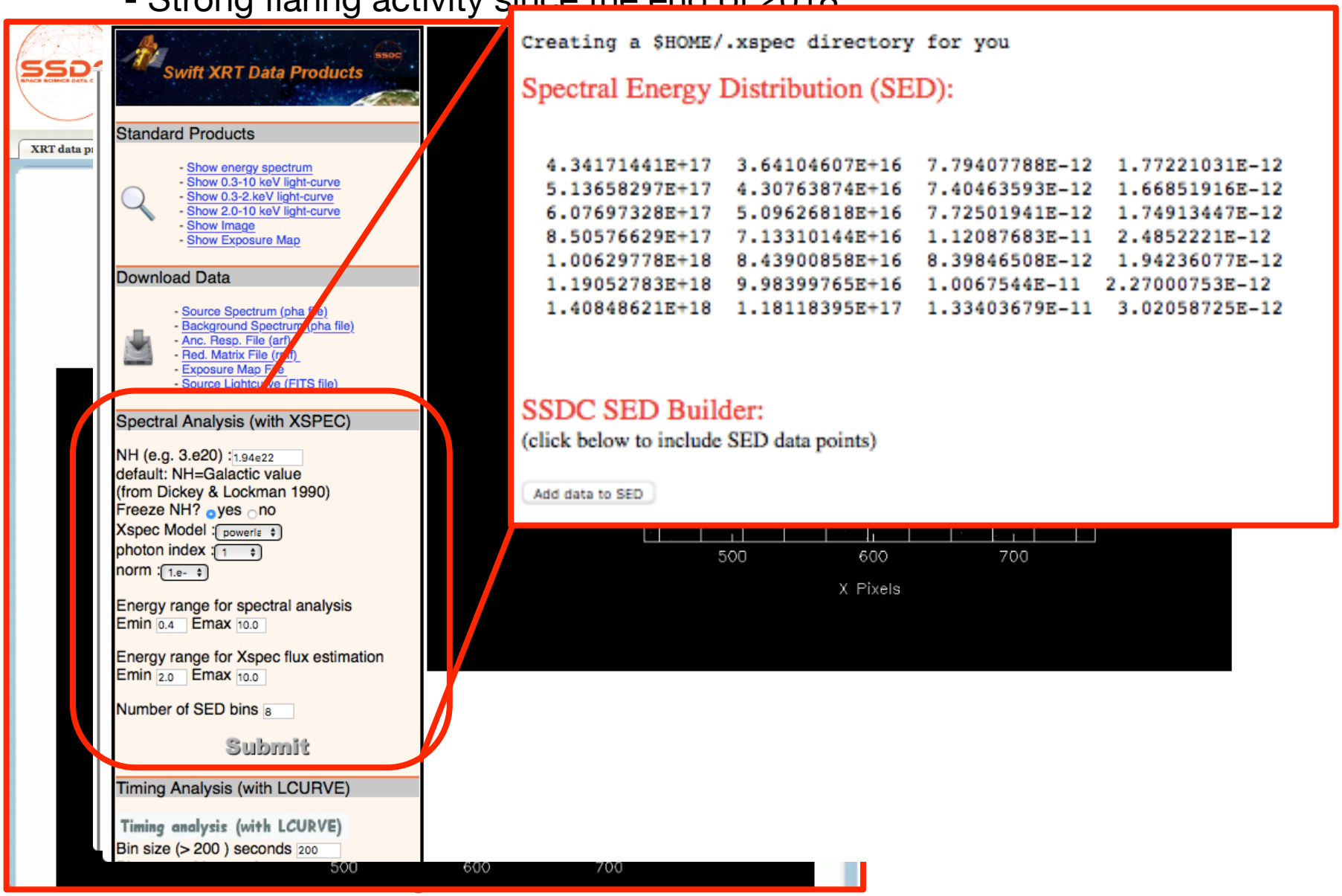


MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018



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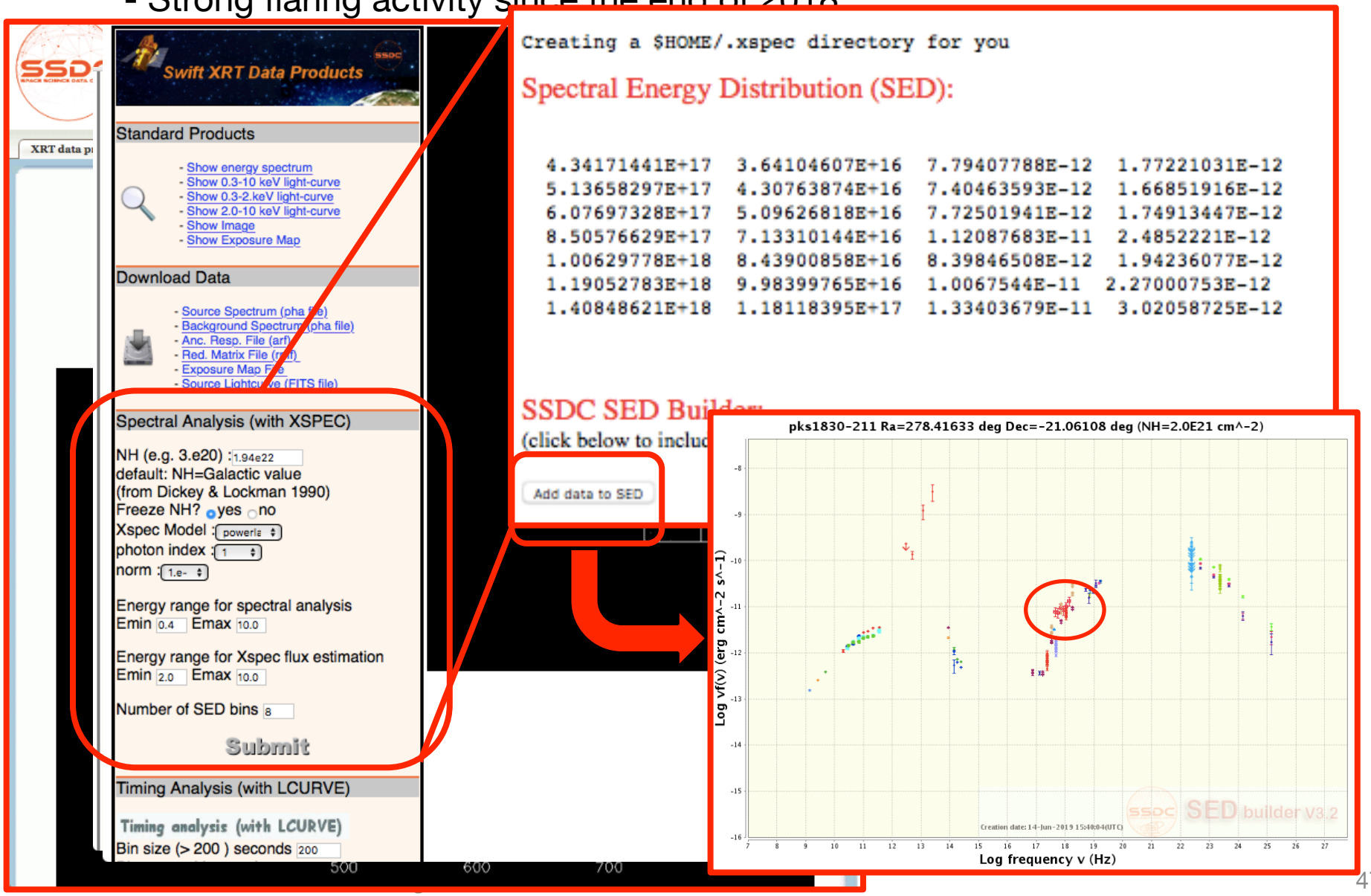
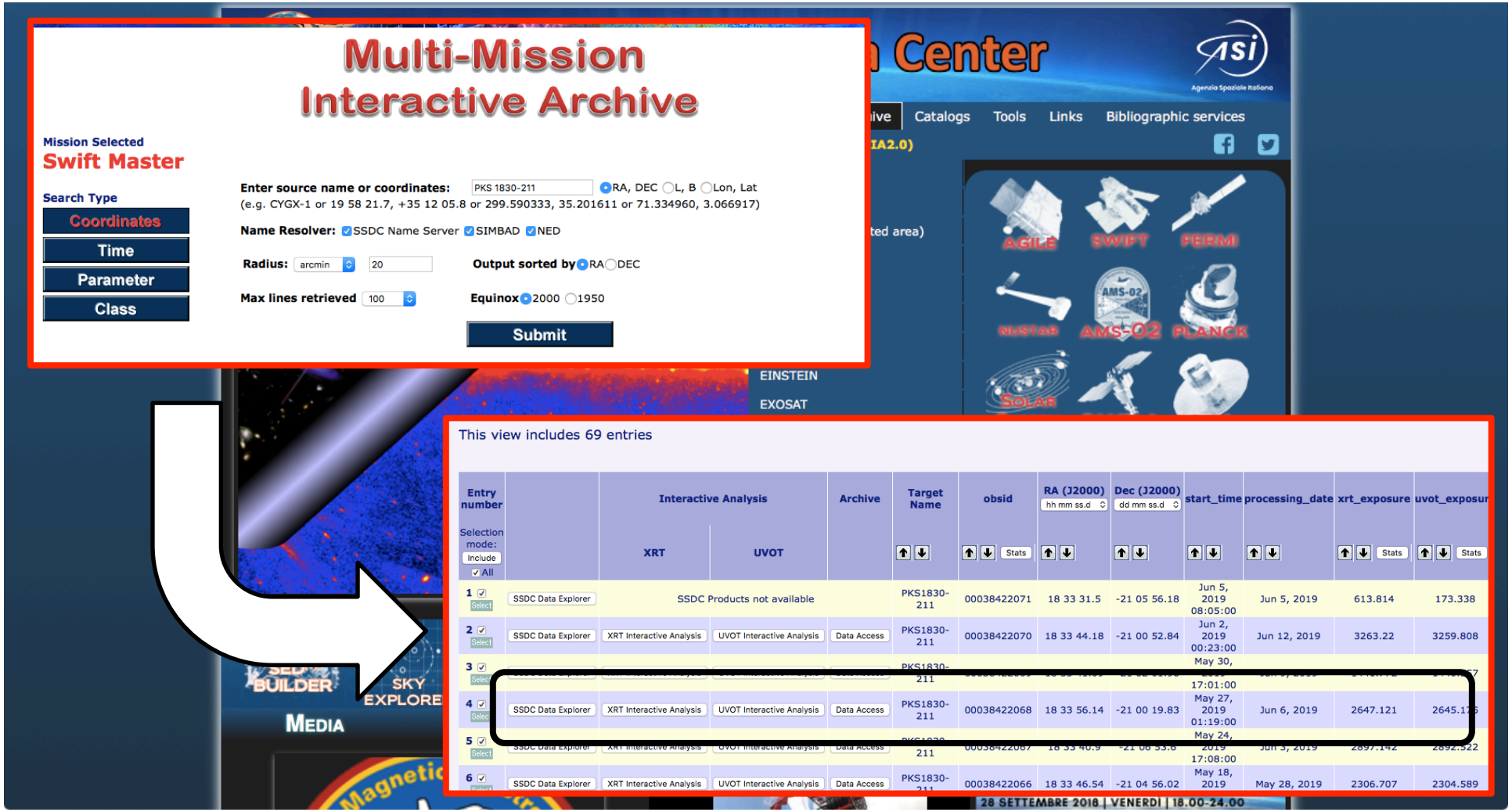
- Strong flaring activity since the end of 2018



MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

SWIFT-XRT data –



MWL QL MONITORING OF PKS 1830-211

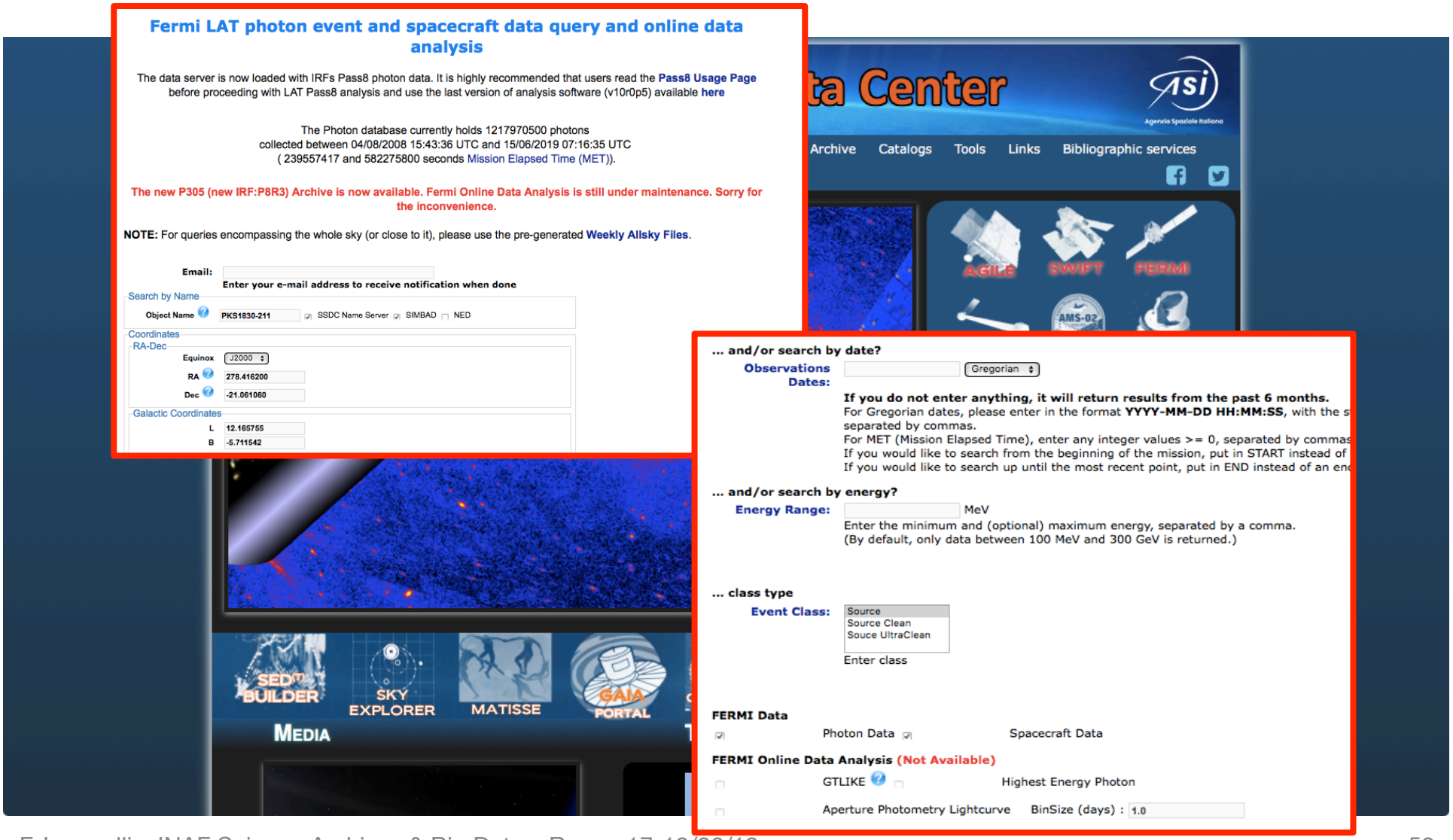
- Strong flaring activity since the end of 2018

FERMI-LAT data –

MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

FERMI-LAT data –



MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

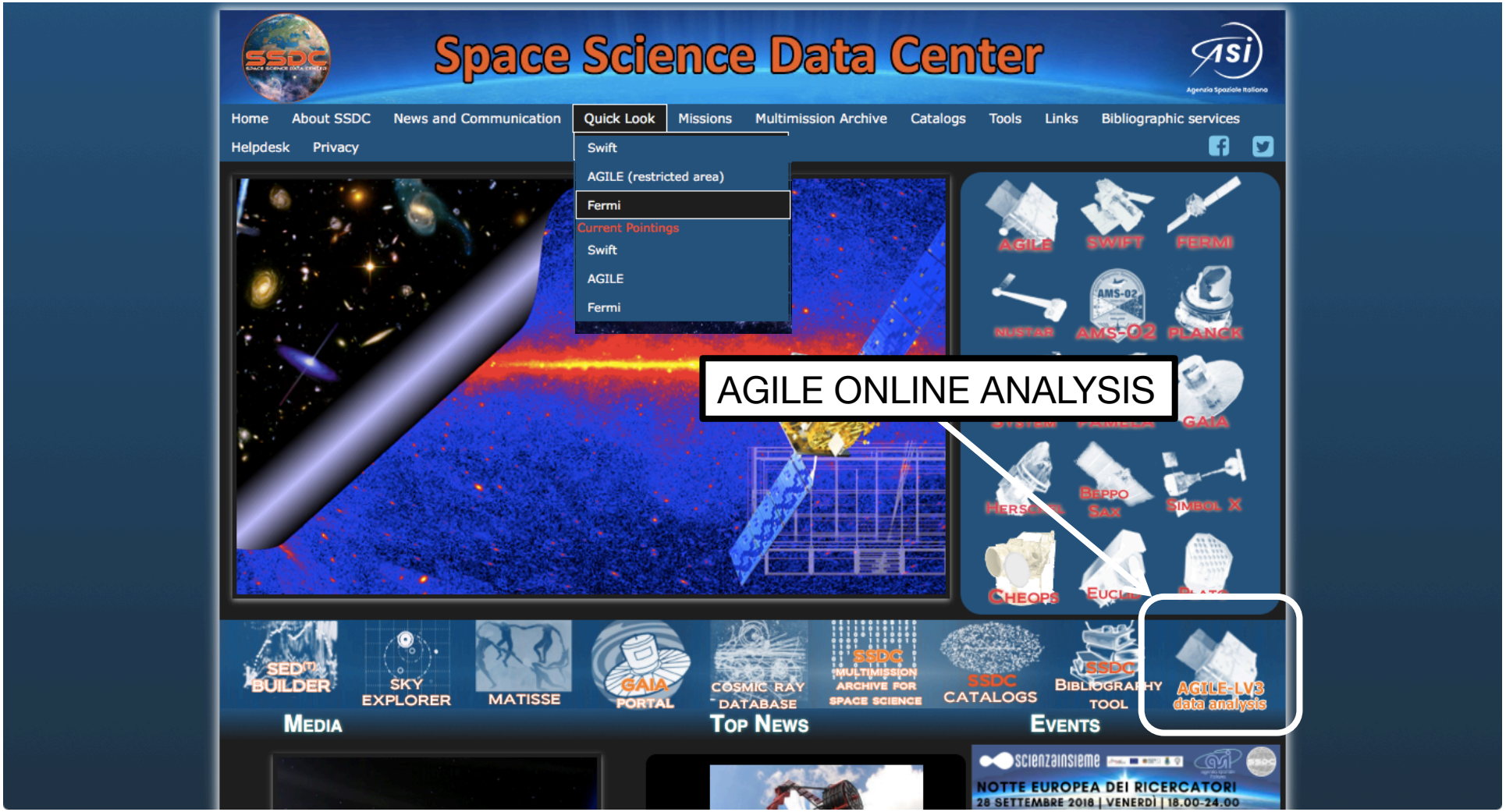
FERMI-LAT data –

FERMI-LAT QL ANALYSIS

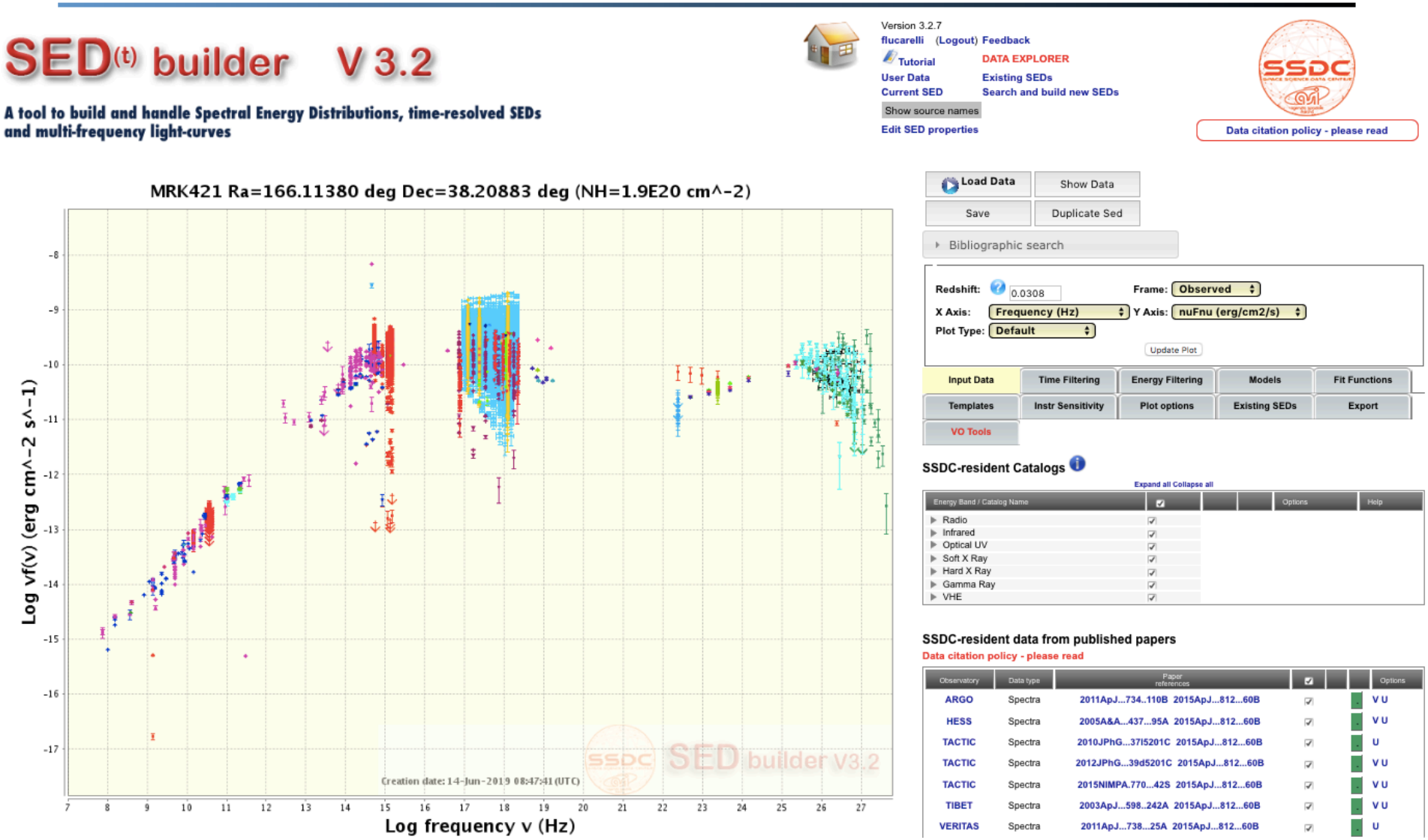
MWL QL MONITORING OF PKS 1830-211

- Strong flaring activity since the end of 2018

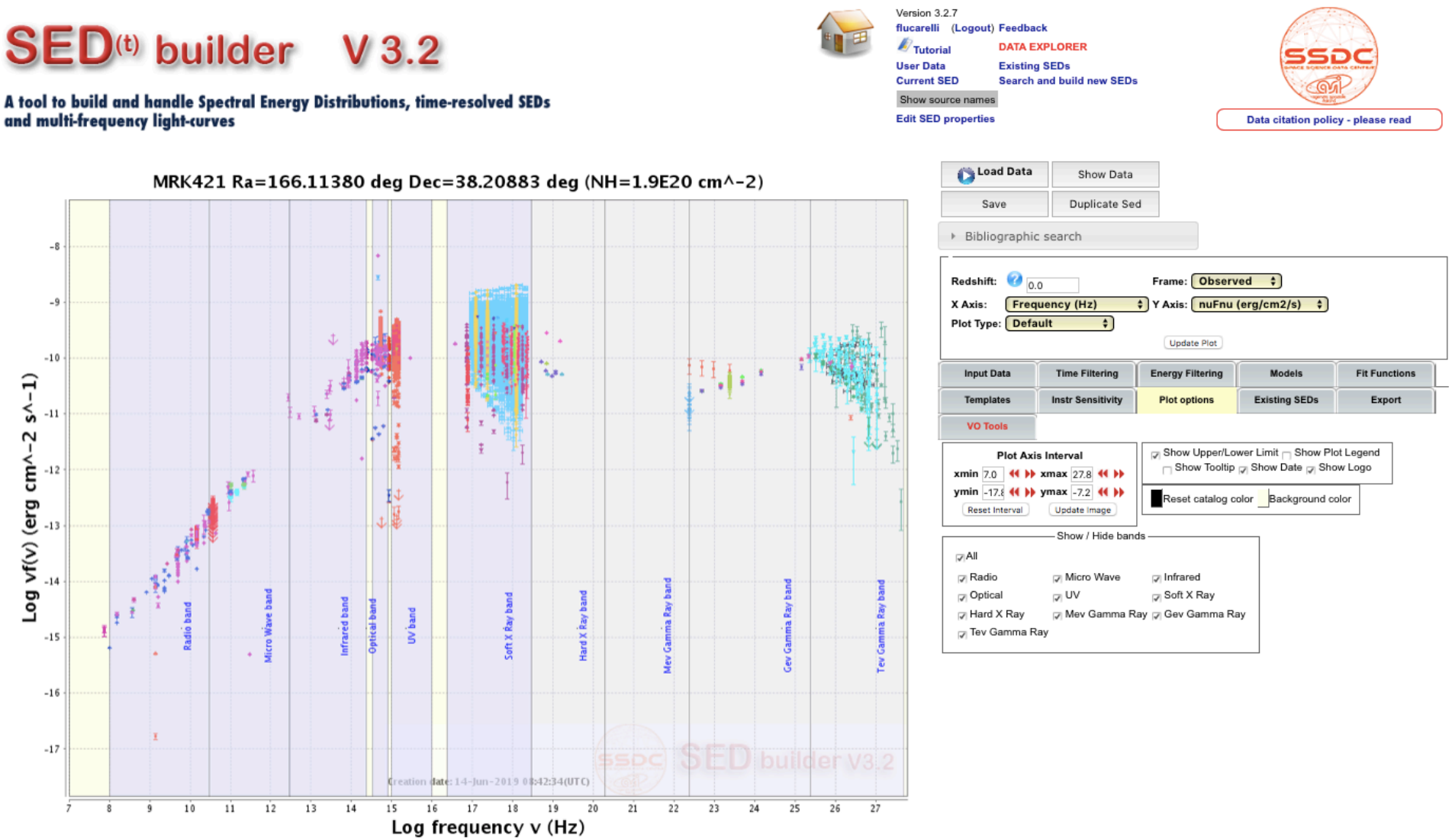
AGILE data



USING *SEDBUILDER*: MRK 421 BROADBAND SED

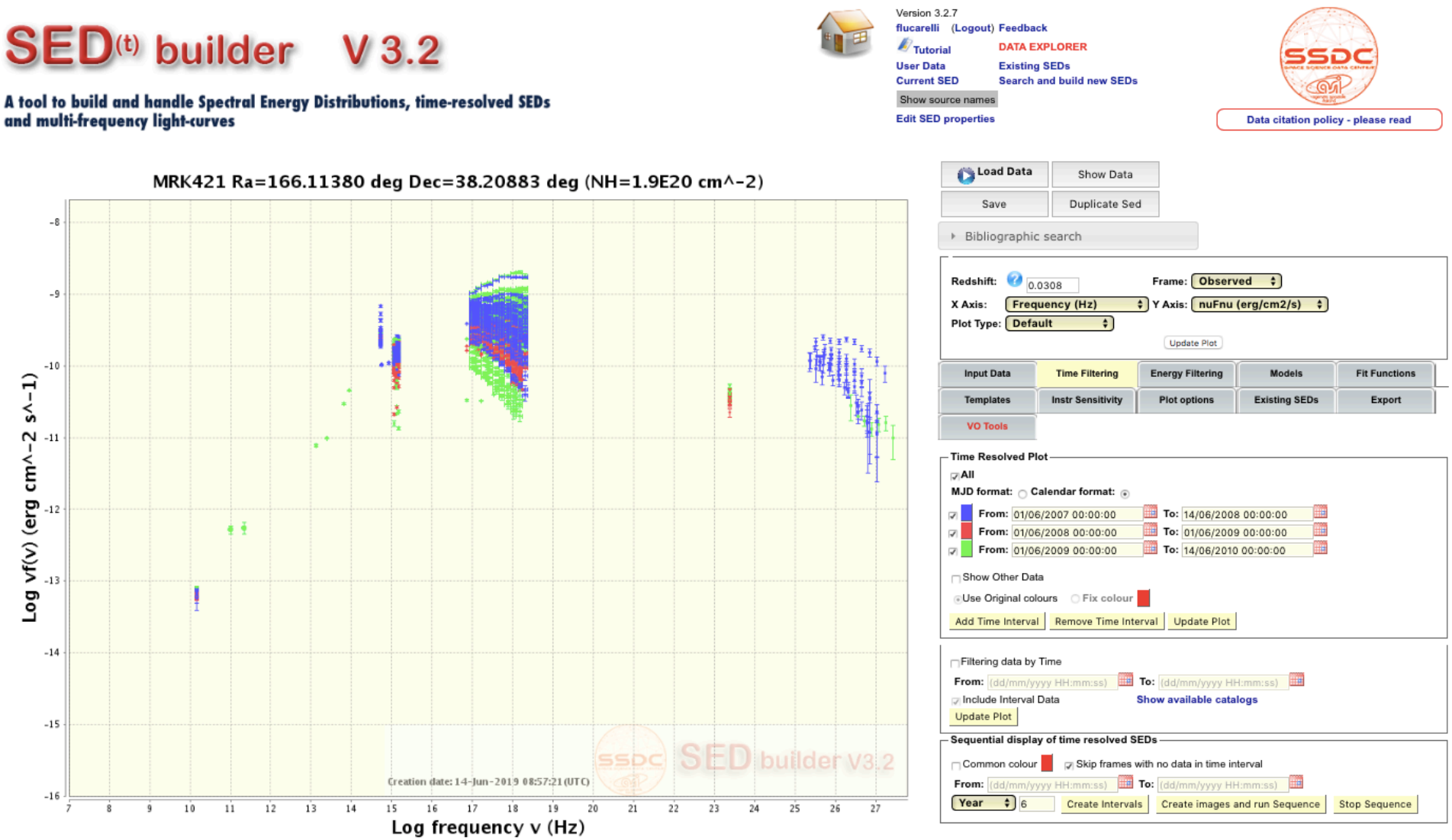


USING *SEDBUILDER*: MRK 421 BROADBAND SED

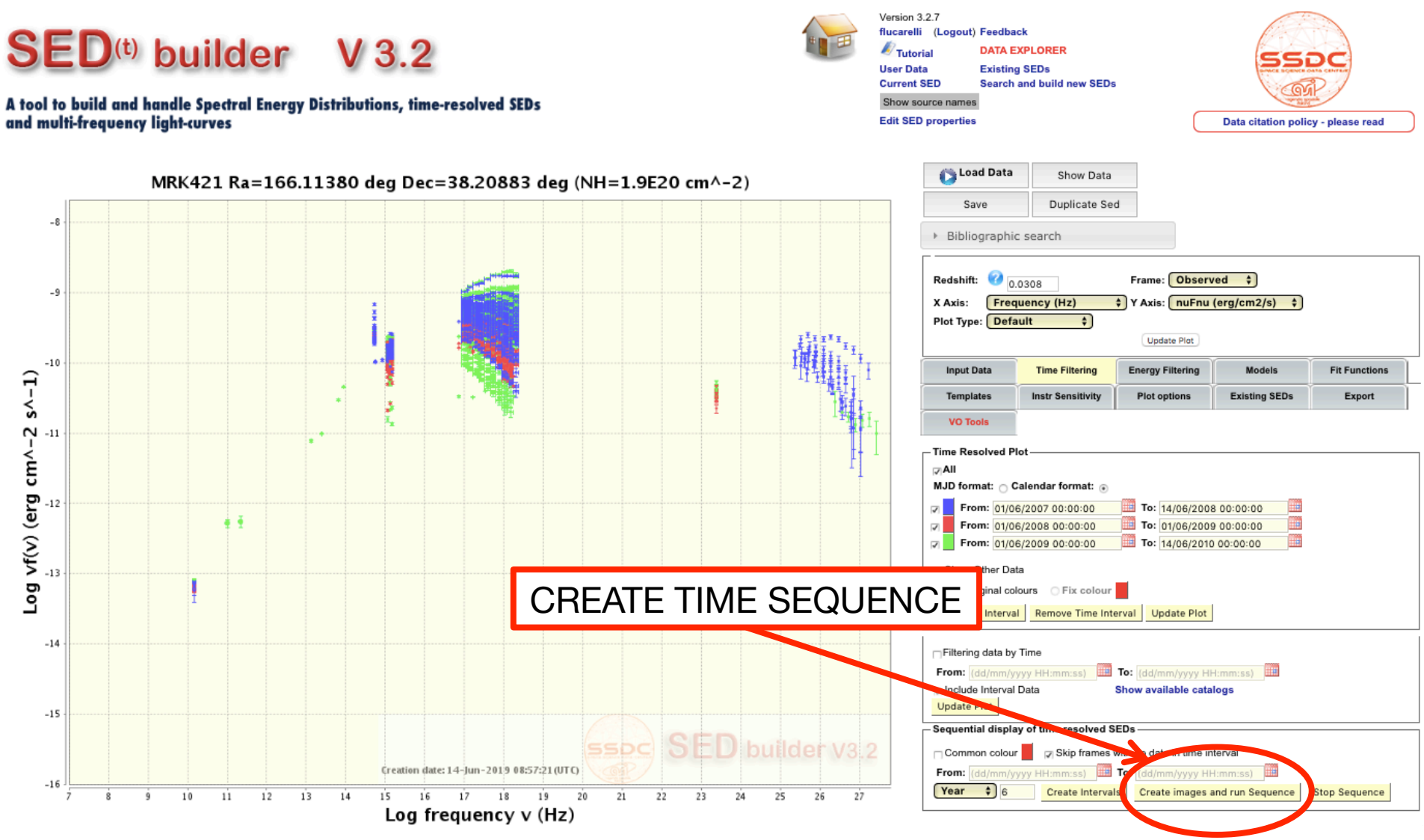


USING *SEDBUILDER*: MRK 421 SSC MODELLING

USING *SEDBUILDER*: MRK 421 MWL VARIABILITY



USING *SEDBUILDER*: MRK 421 MWL VARIABILITY



USING *SEDBUILDER*: MRK 421 MWL VARIABILITY

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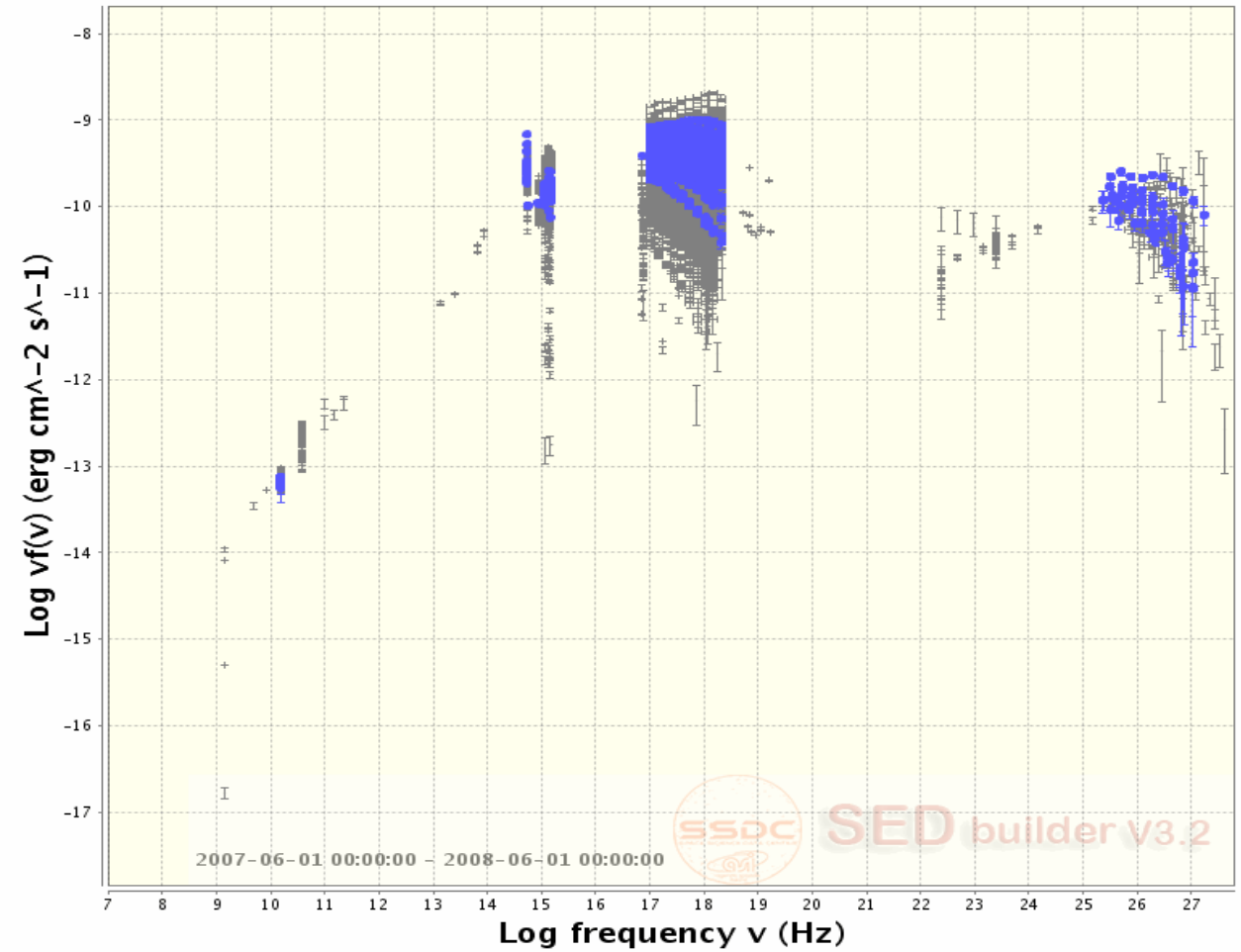
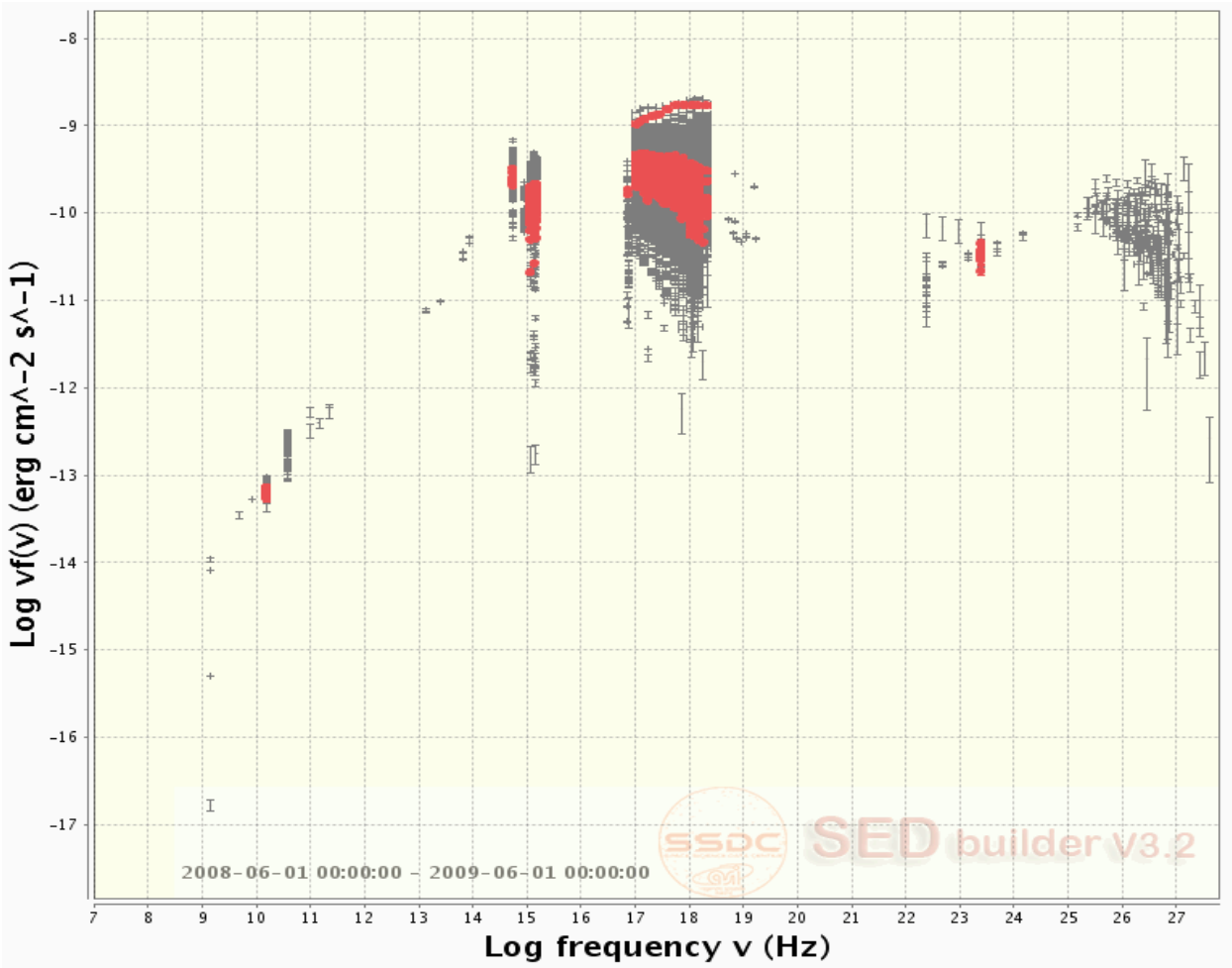


2007

USING *SEDBUILDER*: MRK 421 MWL VARIABILITY



2008

USING *SEDBUILDER*: MRK 421 MWL VARIABILITY

2009

SEARCH FOR EM NEUTRINO COUNTERPARTS: THE CASE OF IC-160731

- Extremely High Energy (EHE) neutrino detected by the ICECUBE experiment at **T0=31/07/2016 01:55:04 UTC**
- Reconstructed arrival direction:

  RA,DEC (J2000)=(214.54, -0.33) +/- 0.75 [deg]

  (90% stat+sys containement radius)

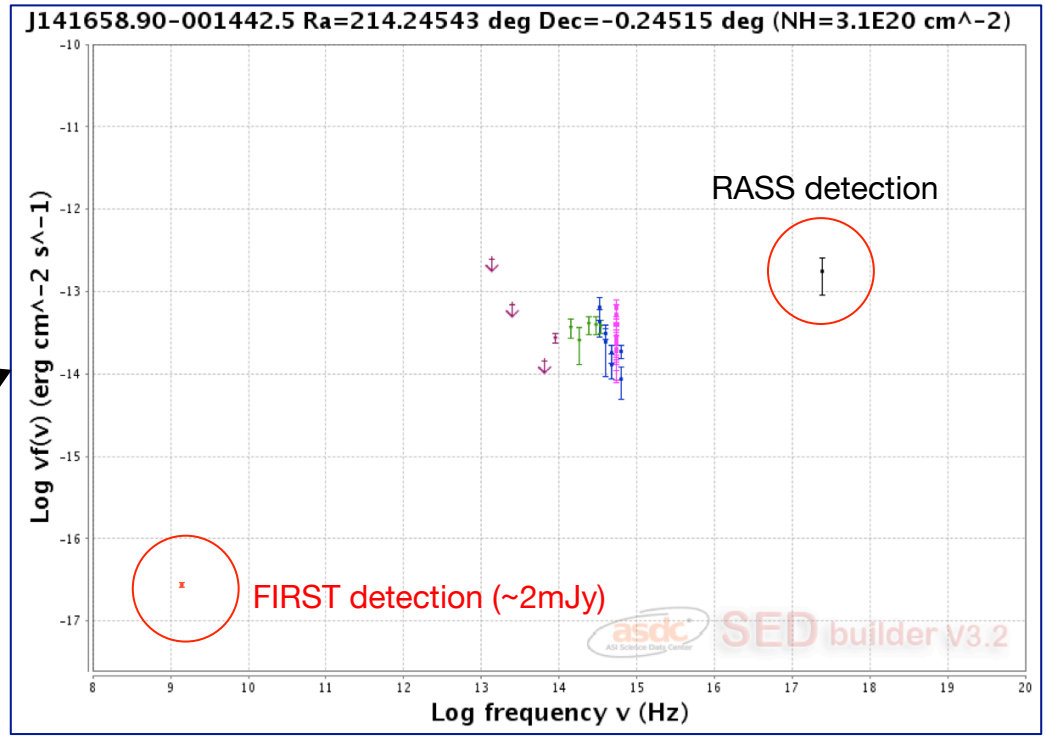
  Gal Coords. l,b=(343.68, +55.52) deg
- No known blazars/LAT sources found inside the ICECUBE-160731 error circle.
- Possible AGILE gamma-ray transient (AGL J1418+0008) seen in correspondence of IC-160731.

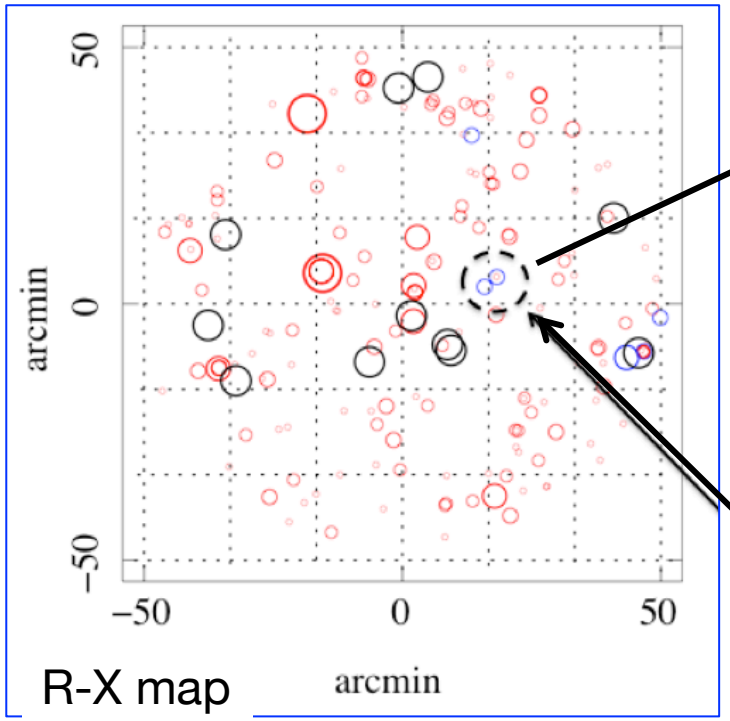
Use SSDC tools (*SkyExplorer* & *SEDBuilder*) to identify the possible EM counterpart

SEARCH FOR EM NEUTRINO COUNTERPARTS: THE CASE OF IC-160731

Search around IC-160731/AGL J1418 using SSDC ***SkyExplorer*** tool

SSDC SEDBuilder Tool

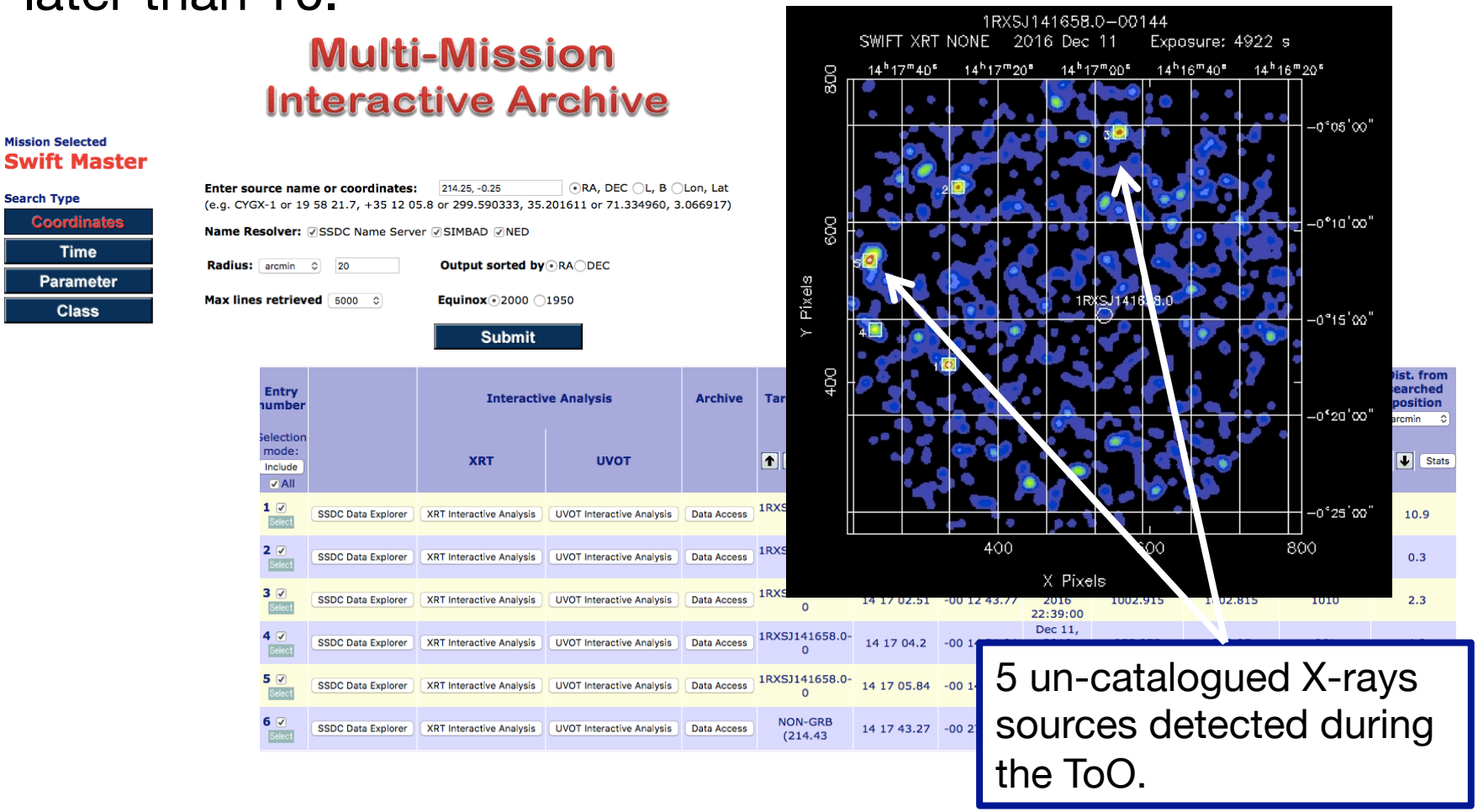




1RXS J141658-00144:
possible HBL blazar candidate ➔
ICECUBE-160731 emitter candidate?

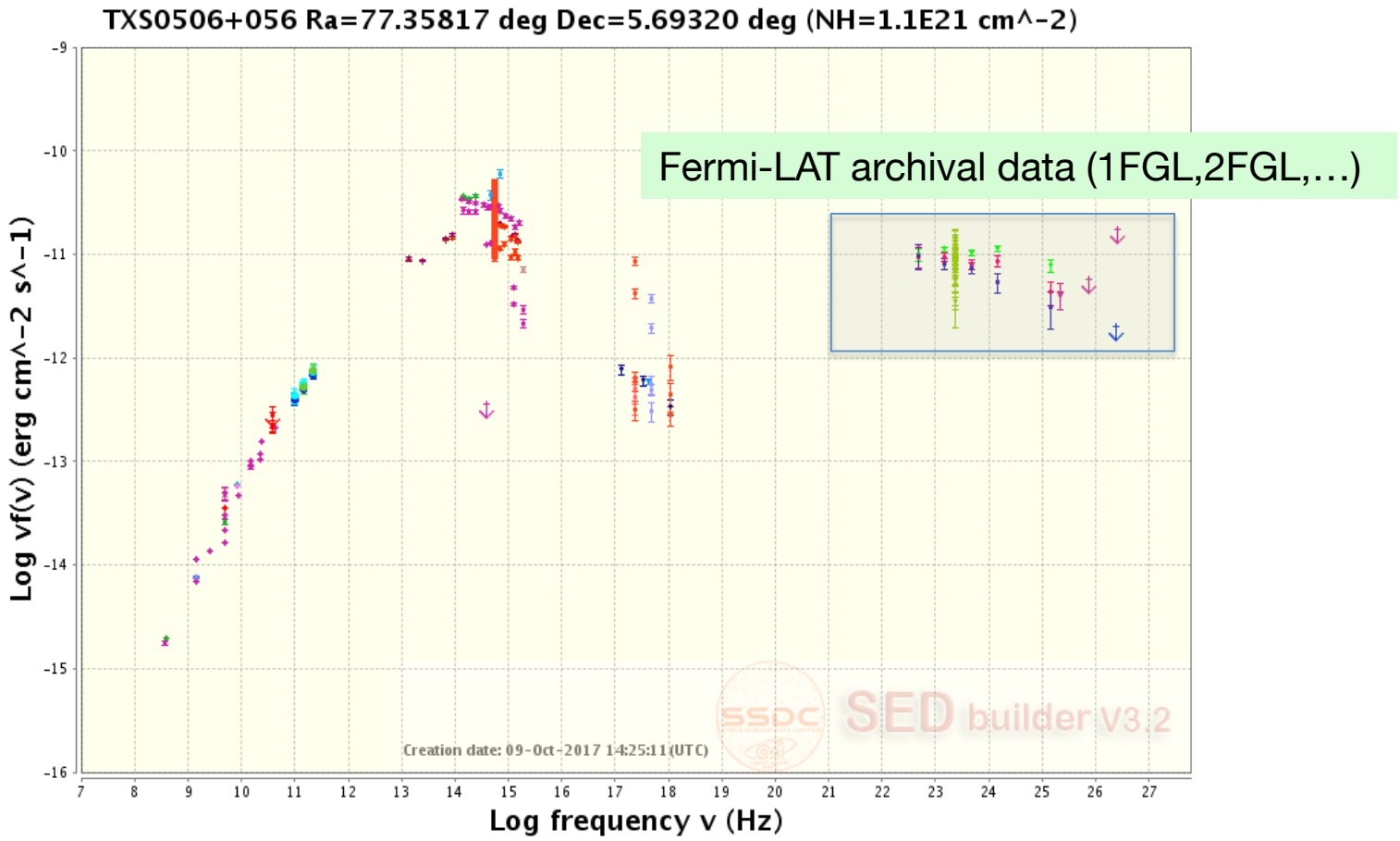
SWIFT ToO-DATA ON 1RXS J141658

- 5-ks SWIFT ToO observations performed ~6 months later than T0.



THE CASE OF TXS 0506+056

- First source of VHE neutrinos: gamma/nu correlated emission observed during Sept. 2017.



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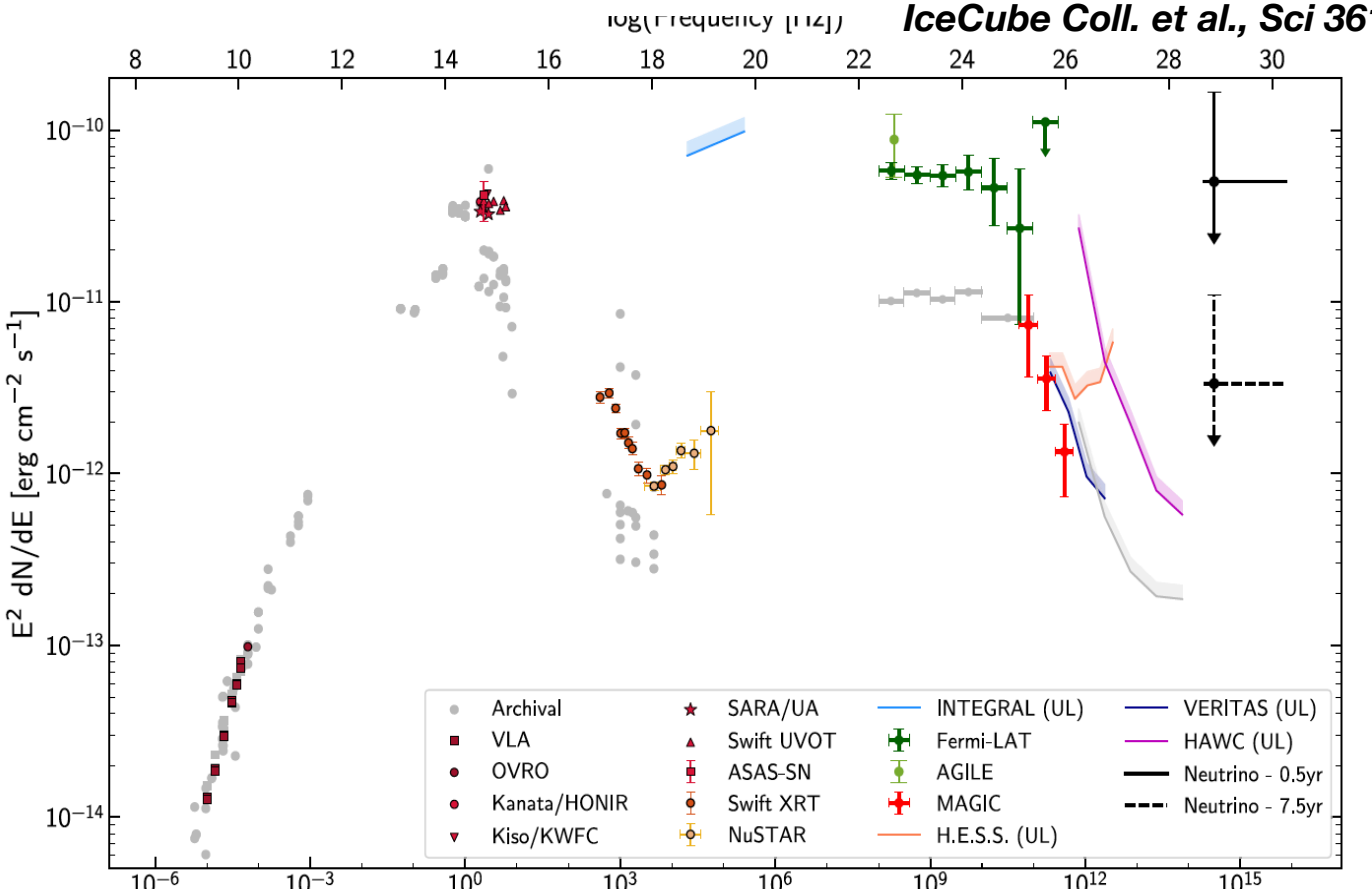
IceCube Coll. et al., Sci 361 (2018)



Archival observations (in gray) retrieved from the SSDC *SEDBuilder*

THE CASE OF TXS 0506+056

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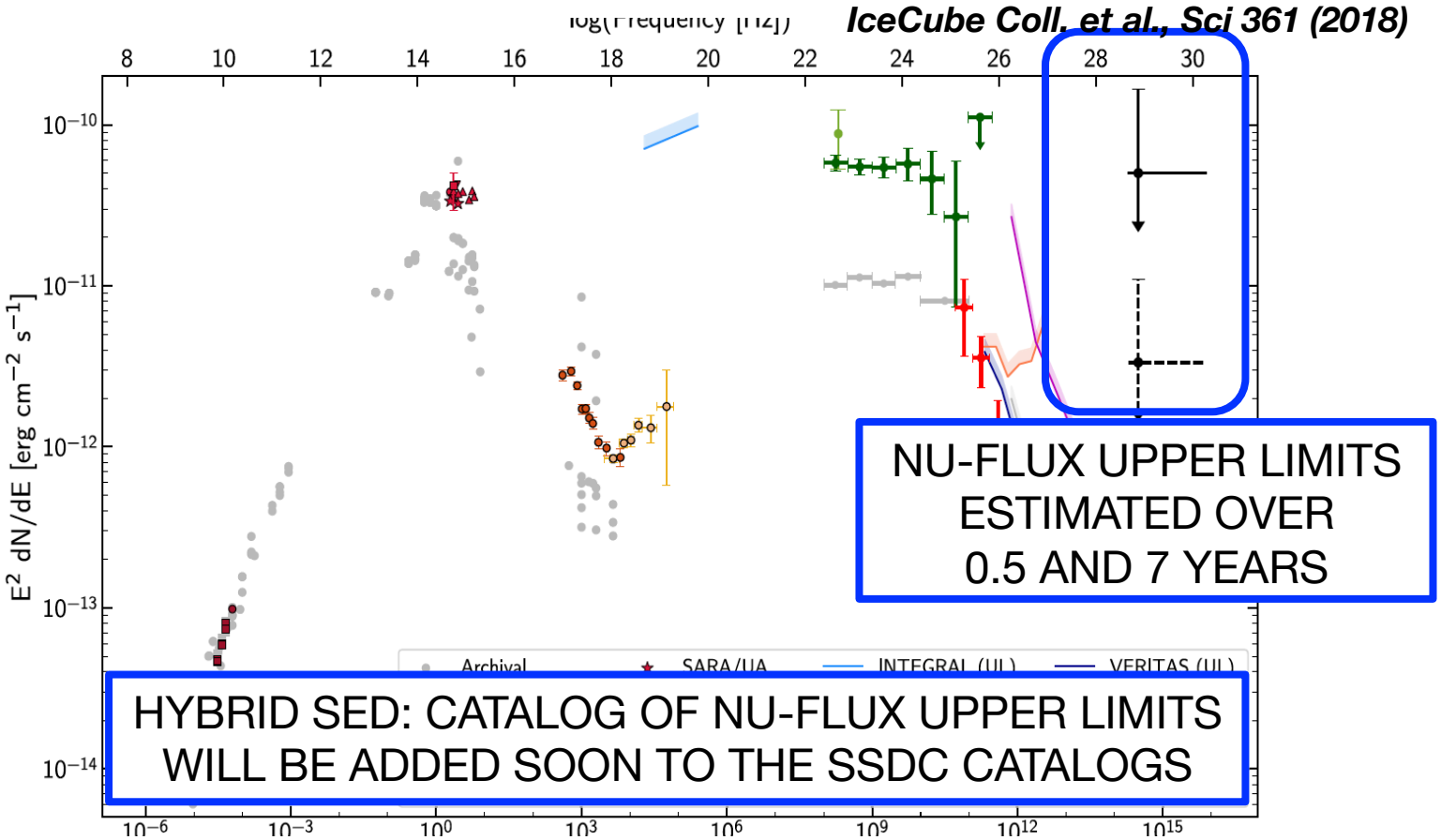
IceCube Coll. et al., Sci 361 (2018)



NU-FLUX UPPER LIMITS ESTIMATED OVER 0.5 AND 7 YEARS

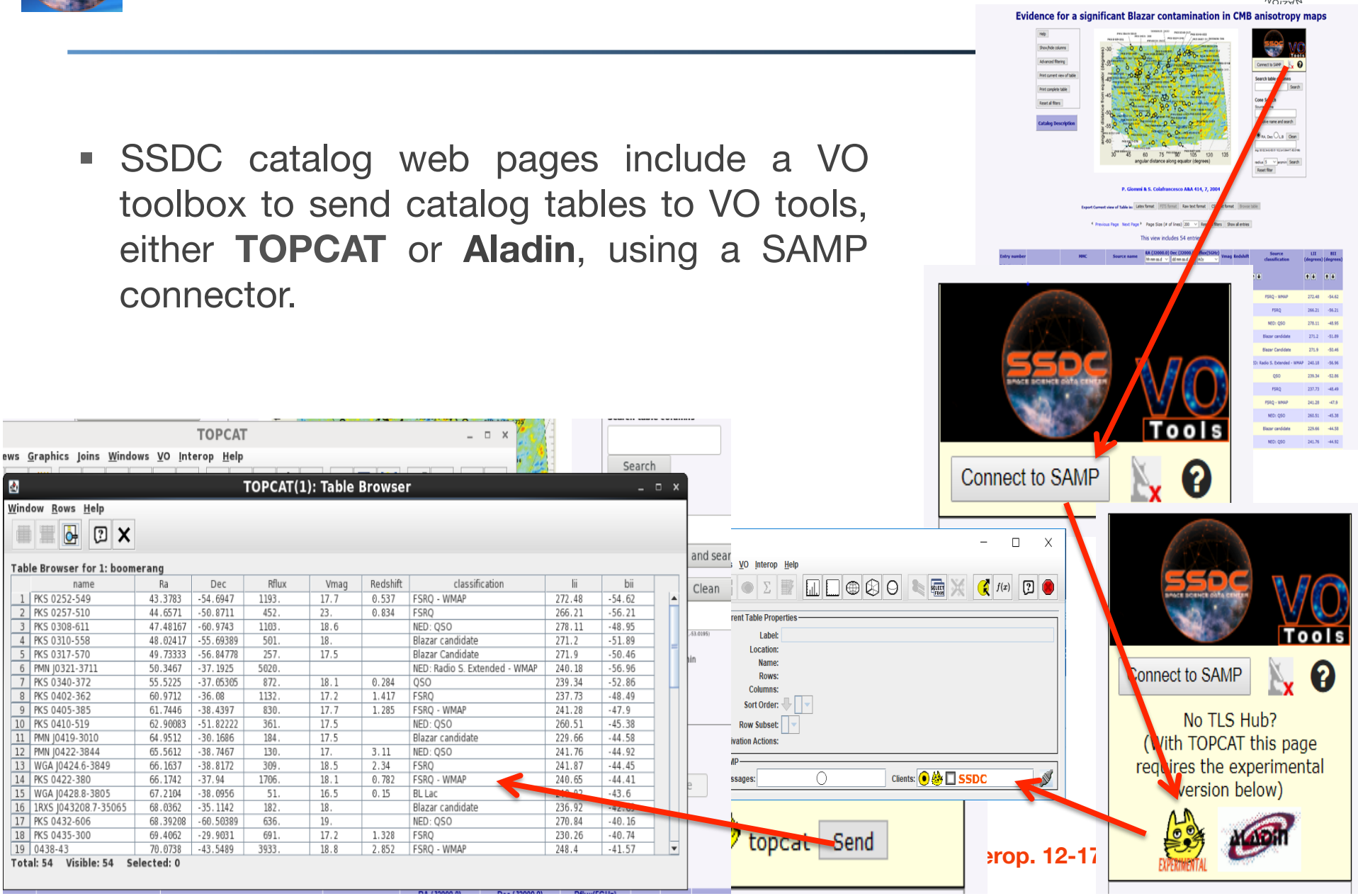
HYBRID SED: CATALOG OF NU-FLUX UPPER LIMITS WILL BE ADDED SOON TO THE SSDC CATALOGS

Archival observations (in gray) retrieved from the SSDC *SEDBuilder*

SSDC VO SERVICES

VO ACTIVITIES: CATALOG SAMP CONNECTOR

- SSDC catalog web pages include a VO toolbox to send catalog tables to VO tools, either **TOPCAT** or **Aladin**, using a SAMP connector.



SUMMARY AND OUTLOOK

- We presented here the main SSDC web tools (*SkyExplorer*, *SEDBuilder*, ⋯) and their use in some typical scientific use cases.
- The MWL SSDC environment provide several unique features that can support a large part of the astronomical community, from HE astrophysics to cosmology, planetology and cosmic ray physics.
- All services and tools are frequently updated (web server upgrade, improve graphical layout, add new features, ⋯) in close synergy with the industrial support.

SSDC STAFF

SSDC team involves around 40 people: scientists from ASI, INAF, INFN and SW engineers from Telespazio & SERCO, experts in different fields.

SSDC Management	
Gianluca Polenta (ASI)	Director
Valerio D'Elia (ASI)	Universe Observation Manager
Marco Giardino (ASI)	ICT Manager
Matteo Perri (INAF)	INAF Project Scientist
Bruna Bertucci (INFN)	INFN Project Scientist

Secretary and Data Assistant	
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Gianluca Perini (INAF) - part time	

ICT	
Giuseppe Di Persio (INAF) - part time	

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Francesco Verrecchia (INAF)	

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Ciro Bigongiari (INAF)	
Saverio Lombardi (INAF)	
Vincenzo Vitale (INFN)	

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Ronaldo Oliveira da Silva (INAF)	

Fermi Team	
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Dario Gasparrini (INFN)	

GAIA Team	
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Giuseppe Altavilla (INAF)	
Michele Fabrizio (INAF)	
Silvia Marinoni (INAF)	

Herschel Team	
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Ronaldo Oliveira da Silva (INAF)	

LIMADOU	
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Vincenzo Vitale (INFN)	

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Alessandra Lamastra (INAF)	
Cristina Leto (ASI)	
Alessandro Maselli (INAF)	
Francesco Verrecchia (INAF)	

NuSTAR Team	
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Simonetta Puccetti (ASI)	

PAMELA
Valeria Di Felice (INFN)

Planck Team	
Gianluca Polenta (ASI)	Coordinat
Gemma Luzzi (ASI)	

Seismic activity/particle correlation
Vincenzo Vitale (INFN)

Solar System Exploration	
Angelo Zinzi (ASI)	Coordinat

Swift Team	
Matteo Perri (INAF)	Coordinat
Valerio D'Elia (ASI)	

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Elisa Nichelli (INAF)

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Fabrizio Fabri (SERCO)	software developer
Giorgio Fanari (SERCO)	software developer
Antonio Guerra (TELESPAZIO)	team leader
Daniele Navarra (SERCO)	web developer
Roberto Primavera (TELESPAZIO)	technical manager
Pier Vincenzo Severo (TELESPAZIO)	team specialist

Senior Scientists	
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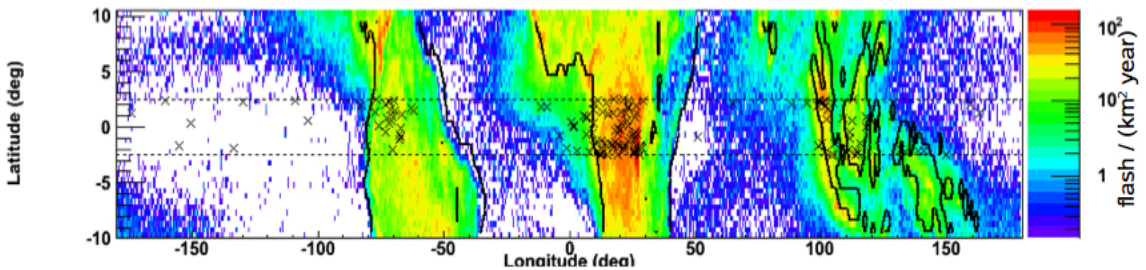
Roberto Buonanno (INAF-OA Teramo e Univ. Roma Tor Vergata)	GAIA
Maria Teresa Capria (INAF-IAPS Roma)	ESS (Solar System Explora
Elisabetta Cavazzuti (ASI)	Fermi
Domenico D'Urso (Univ. Sassari ed INFN-LNS)	AMS/DAMPE
Paolo Giommi (ASI)	Open Universe
Paolo Natoli (INAF-IASF Bologna e Univ. Ferrara)	Planck, Fermi
Ernesto Palomba (INAF-IAPS Roma)	ESS (Solar System Explora
Elena Pancino (INAF-Osservatorio Astrofisico Arcetri)	GAIA
Piergiorgio Picozza (INFN Roma2)	PAMELA
Antonio Stamerra (INAF-OA Torino)	MWL, CTA, Fermi
Simona Zoffoli (ASI)	LIMADOU

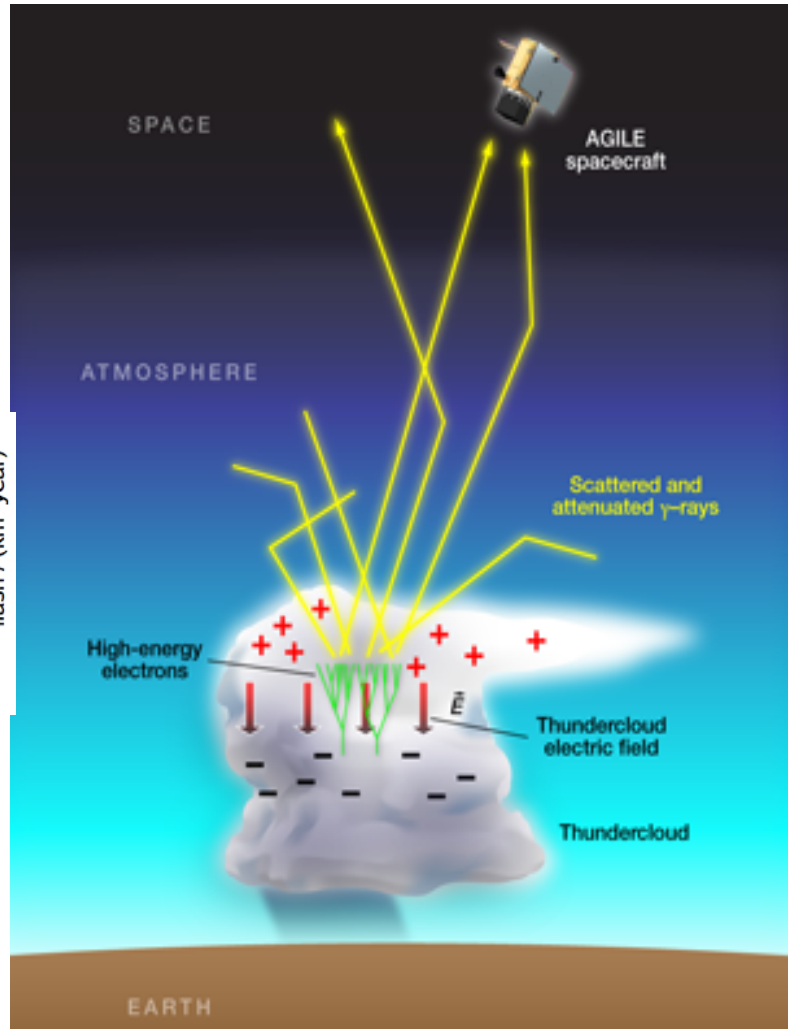
ssdc.asi.it

BACKUP SLIDES

Terrestrial Gamma-ray Flashes (TGF) seen with AGILE up to energies > 100 MeV!!!

Very short flashes, on millisecond timescales but very energetic. Good match between AGILE TGF pattern and lightning map during tropical storms





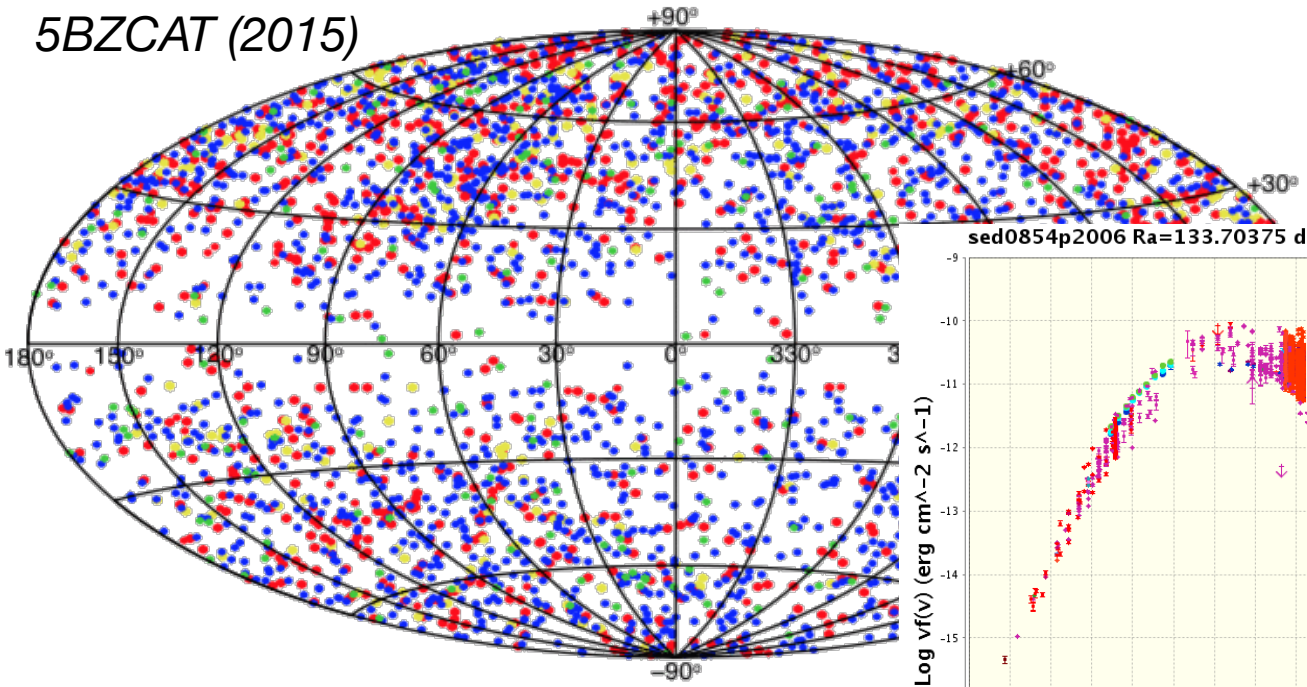
- Normal lightning d.d.p. ~ 500 kVolts

- **TGF: d.d.p. > 100 MVolts !**

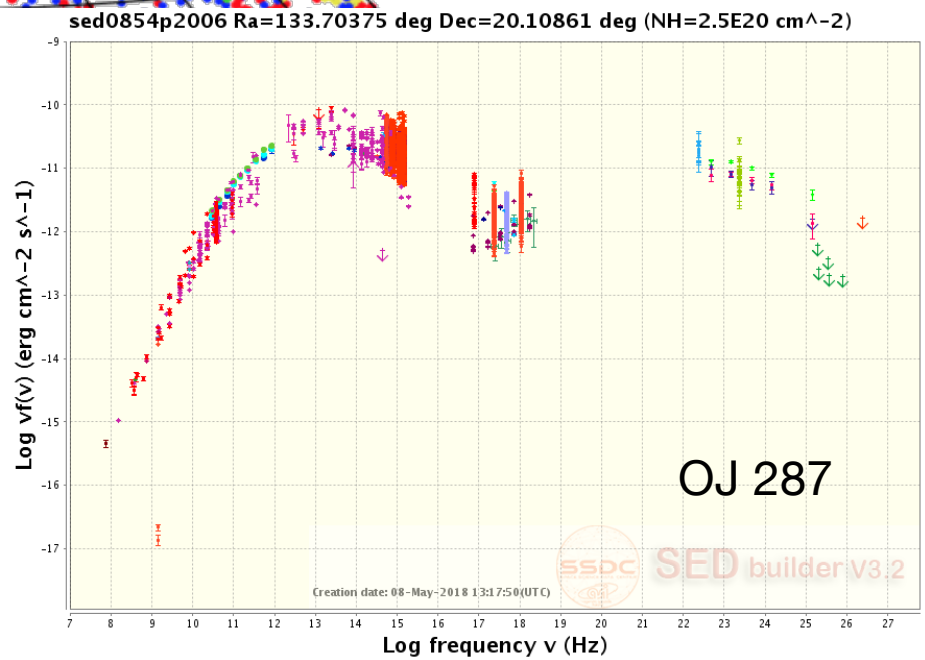
A real-time monitoring and alert system can be implemented for correlation with other meteo resources (work in progress)

BLAZAR CATALOGS @ SSDC

5BZCAT (2015)



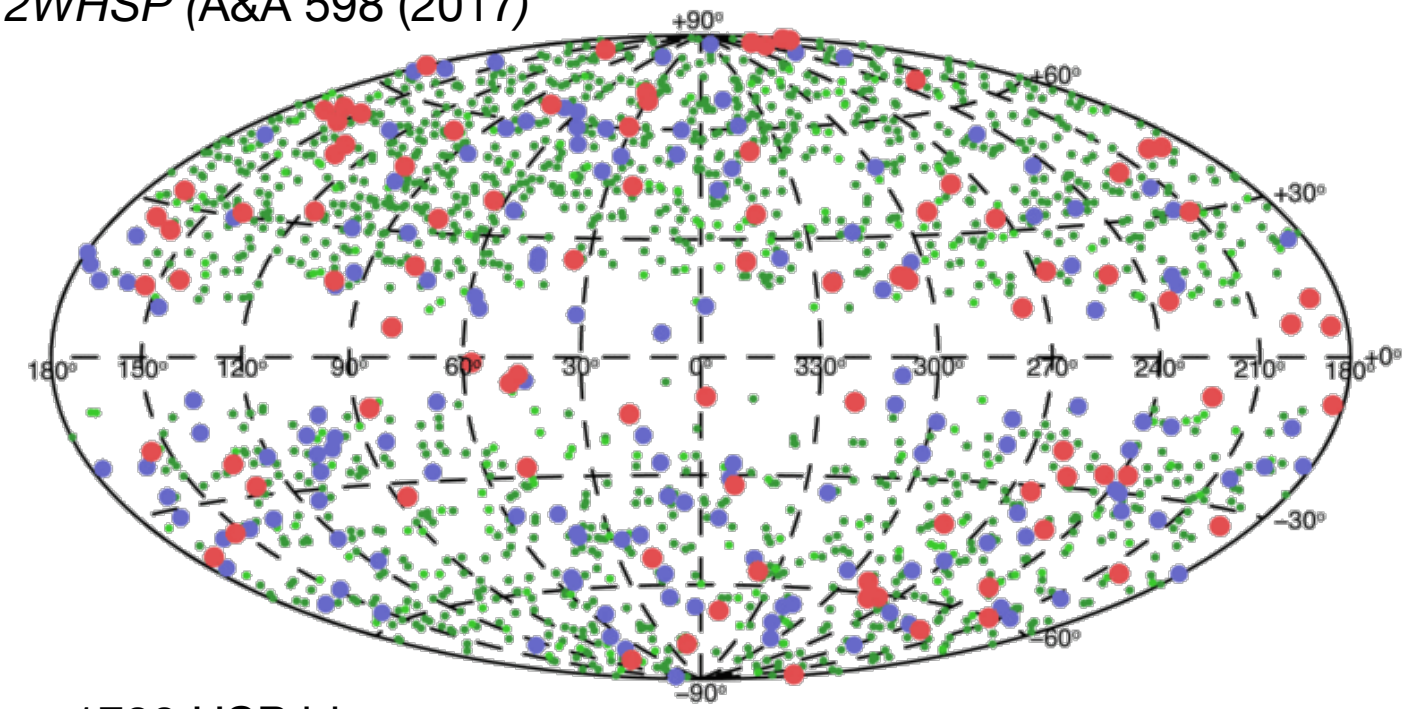
>3500 Blazars AGNs



Multi-frequency catalog of blazars. Blazar selection criteria based on SED and evidence for relativistic beaming. Catalog frequently updated (5th edition in 2015). Fully integrated in the MWL SSDC environment.

BLAZAR CATALOGS @ SSDC

2WHSP (A&A 598 (2017)

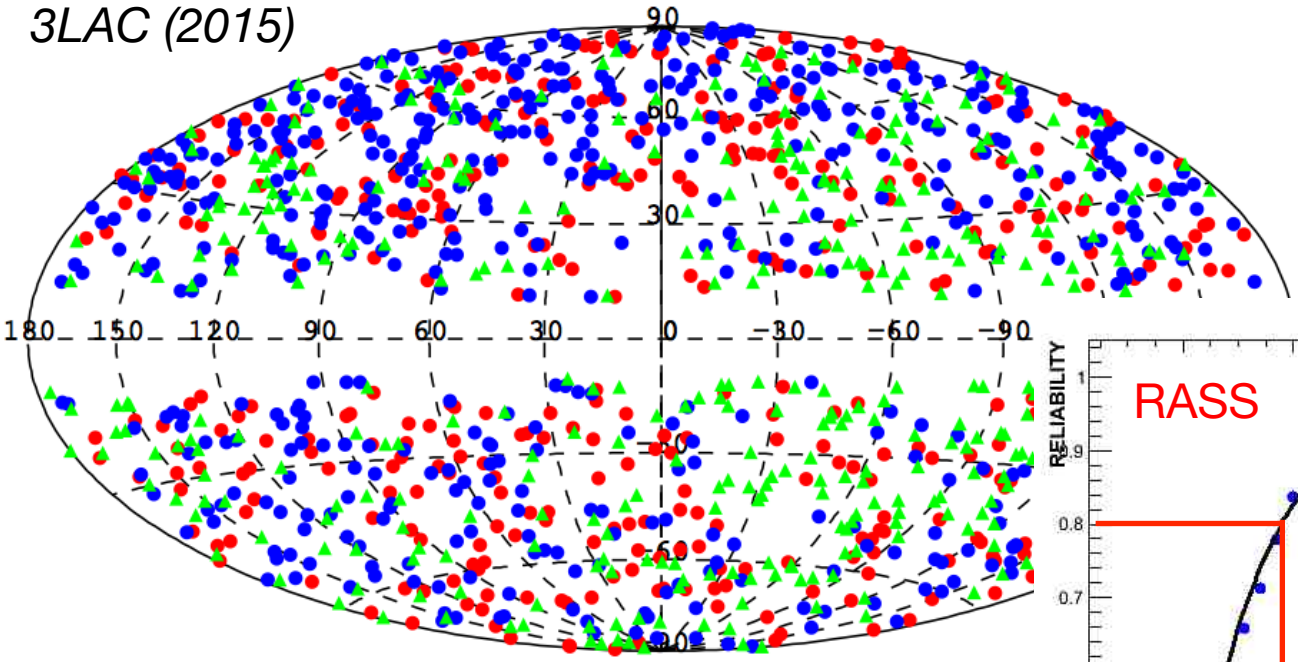


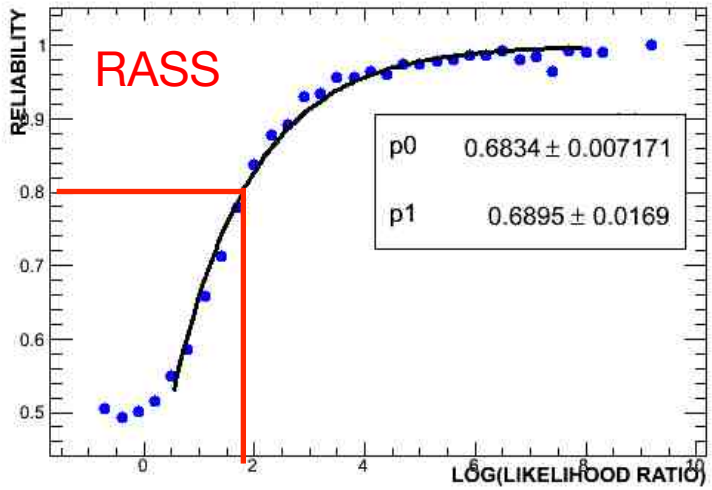
~1700 HSP blazars

Catalog of selected High-synchrotron peak (HSP) BL Lac blazars.
Cross-matched MWL radio (NVSS, FIRST, …)/IR (WISE)/X-Ray surveys and applied selection criteria based on the radio-to-IR and IR-to-X-ray spectral slopes. Examined the SED of each individual candidate.

FERMI-LAT AGN (LAC) CATALOGS @ SSDC

3LAC (2015)





>1700 AGNs

Likelihood Ratio (LR) association method for Fermi LAC catalogs developed @ SSDC. Use uniform radio/X-rays surveys (NVSS, SUMSS, RASS, …) for gamma-ray counterpart serch. Use of source flux (log N - log S).

LAC CLASSIFICATION

Identification of the associated sources:

➔checking source by source the association list created with sources with association probability greater than 80% in at least in one method.

Collecting Multi-wavelength information:

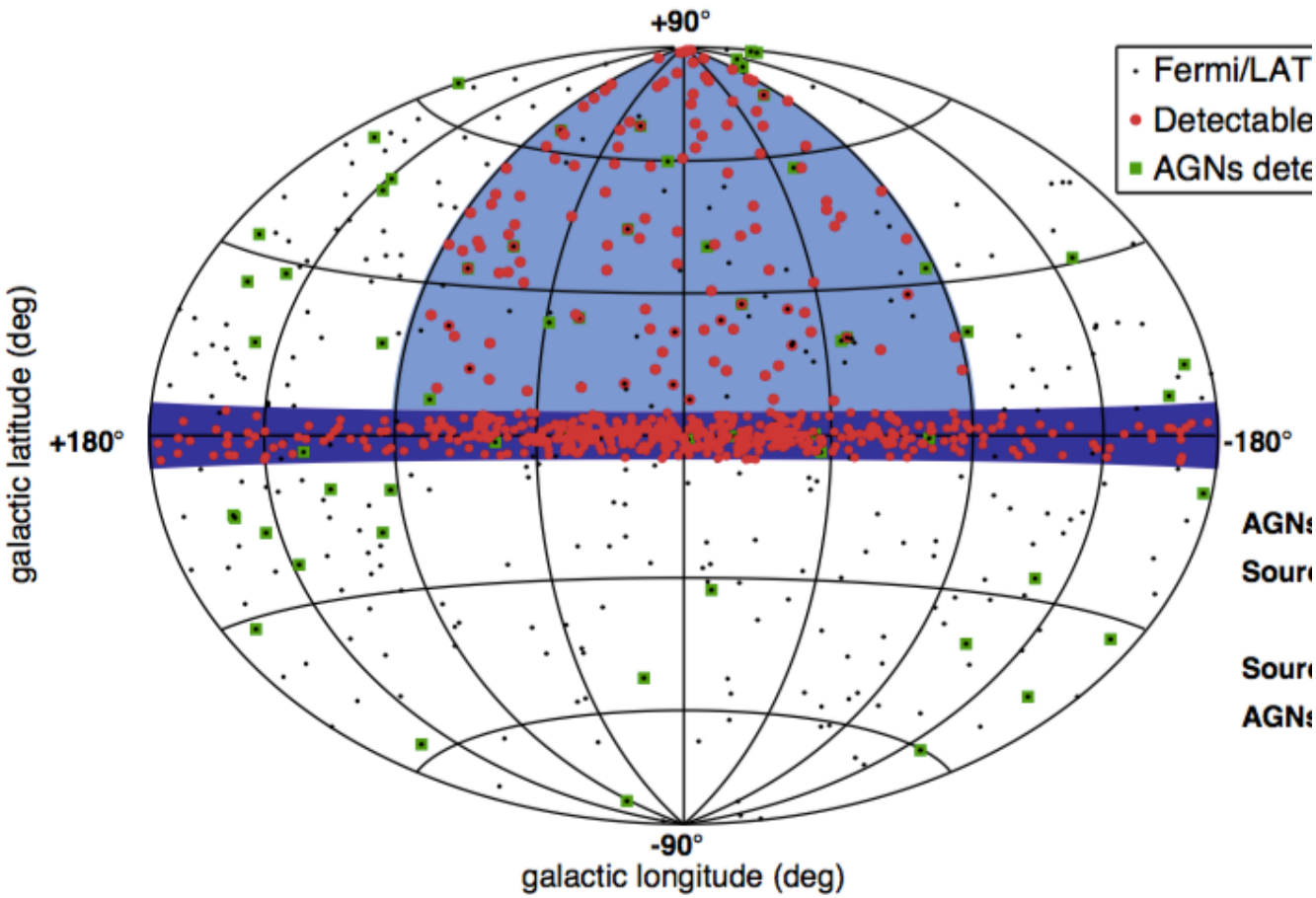
➔Search for the “blazarness” of a source

- **Building Spectral energy distribution (SED)**

  ➔individuating if the source has a flat radio spectrum

  ➔Broad band emission, double humps SED, lie on WISE blazars strip

- **Searching for optical spectrum**

  ➔Checking redshift (SDSS, NED, …)

ASSOCIATION WITH FERMI-FHL